

**BROWNFIELDS PROGRAM
FIELD SAMPLING PLAN
FOR THE
DALLAS WEST CHURCH OF CHRIST SITE
BSA G163
3400 and 3500 North Hampton Road
Dallas, Dallas County, Texas**




Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg. D
Austin, Texas 78753
September 2014

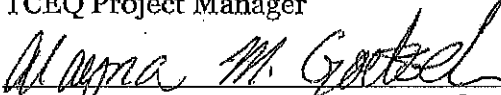
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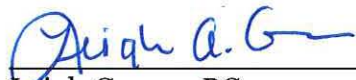
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Contractor Acknowledgement

I am responsible for some or all of the contracted activities conducted under this field sampling plan (FSP). I have reviewed this Dallas West Church of Christ FSP and the TCEQ Quality Assurance Project Plan for the Superfund Programs (Revision 11.0, Q-TRAK# 14-453) (QAPP). I understand this FSP and the QAPP together constitute the technical requirements for the site, and I understand that the terms of the current Assessment, Investigation, and Remedial Services Contract apply. I understand the project objectives and acknowledge receipt of the plan.



Leigh Grover, PG

Project Manager

CB&I Environmental & Infrastructure, Inc.

09/19/14

date



Sushama Paranjape

Project Quality Assurance Officer

CB&I Environmental & Infrastructure, Inc.

09/19/2014

date

Laboratory Acknowledgement

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List of Acronyms

AST	Above ground storage tank
BGL	Below ground level
COC	Chemical of concern
DQO	Data quality objectives
DUS	Data usability summary
EDD	Electronic data deliverable
EPA	U. S. Environmental Protection Agency
FB	Field blank
FD	Field duplicate
FSP	Field sampling plan
GPS	Global positioning system
HASP	Health and safety plan
HRS	Hazard Ranking System
H&SO	Health and Safety Officer
IDW	Investigation derived waste
IRA	Immediate removal action
MCL	Maximum contaminant level
MDL	Method detection limit
MLQ	Method quantitation limit
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MS/MSD	Matrix spike/matrix spike duplicate
NFA	No Further Action
PAH	Polynuclear aromatic hydrocarbons
PCL	Protective concentration limit
PM	Project manager
ppb	Parts per billion
ppm	Parts per million
PST	Petroleum Storage Tank
PWS	Public water system
QAPP	<i>TCEQ Quality Assurance Project Plan for the Superfund Programs</i>
QA	Quality assurance
QC	Quality control
RCRA	Resource Conservation and Recovery Act
SDL	Sample detection limit
SOP	Standard operating procedure
SVOC	Semi volatile organic compound
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
TPH	Total petroleum hydrocarbons
UST	Underground Storage Tank
VOA	Volatile organic analysis
VOC	Volatile organic compound
WO	Work order

1.0 Introduction and Data Quality Objectives

This site-specific field sampling plan (FSP) and the TCEQ *Quality Assurance Project Plan for the Superfund Programs* (Revision 11.0, Q-TRAK# 14-453) (QAPP) constitute the technical requirements for the Brownfields Phase II Environmental Site Assessment (ESA) at the Dallas West Church of Christ Site (the Site). This FSP and QAPP shall function as a stand-alone project document for the Site. The work associated with this FSP is being conducted under Contract No. 582-14-40666. The reference documents followed in the preparation of this FSP are EPA/540/G-91/013 “Guidance for Performing Preliminary Assessments under CERCLA,” EPA/540-R-92-021 “Guidance for Performing Site Inspections under CERCLA,” and those documents listed in Element A.1 of the QAPP.

The TCEQ Project Manager (PM) will distribute the QAPP and FSP to the TCEQ project personnel, the EPA Region 6 project personnel, and the contractor presented in the project organization chart in Figure 1.

1.1 Site Location and Description

This Site is located 0.95 miles northwest of the RSR Corporation facility, a U.S. EPA Superfund Site (RSR Corporation Federal Superfund Site). The Site is located at 3400 and 3500 North Hampton Road, Dallas, Dallas County, Texas and is presented in Figure 2, Site Location Map. The RSR Corporation Federal Superfund Site is an abandoned secondary lead smelter facility which processed used batteries and other lead-containing materials. Historical activities conducted on the RSR Corporation Federal Superfund Site may have resulted in aerial deposition of metals onto the surface soils of the Site. Additionally, Mr. Sammie Berry, Minister of the church, indicated the site was historically a lake and had uncontrolled solid waste disposal. The location and types of waste disposed at the dump is unknown.

The Site consists of two (2) irregular shaped parcels of land comprising approximately 248,205 square feet. On-site is a 12,224 square foot two-story church and office, a 2,964 square foot one-story structure used to house clothing and other items for the needy, an associated asphalt and concrete parking lot, and undeveloped vacant land. The office building is located in the southern portion of the Site. The church/office building is a masonry, block, and tilt-wall structure on a concrete slab. The one-story structure is a wood frame building on a concrete slab. The property was undeveloped land prior to 1979 construction of the current church/office building. The future use of the Site is for church related activities and the construction of a community garden for local residential use.

The elevation at the Site is approximately 407 feet above mean sea level. The geologic stratigraphic unit for the area is alluvium from the Phanerozoic/Cenozoic/Quaternary/

Holocene eras. The alluvium consists of alluvial and low terrace deposits along streams, sand, silt, clay, and gravel where thickness is variable. The Site is surrounded by commercial properties to the northwest, vacant land and baseball fields to the west, residential properties to the north, northeast, east, and south and a church to the southeast. The Site is approximately 0.75 miles southeast of the Trinity River. In the area, groundwater is approximately 10 to 30 feet below ground surface and is used primarily for irrigation. The groundwater gradient is anticipated to flow to the northeast, toward the Trinity River.

Sources of target chemicals of concern (COCs) may be the suspected uncontrolled solid waste dumped on the site and the RSR Corporation Federal Superfund Site. The contaminant migration pathways of concern are surface and subsurface soils and groundwater. The migration pathways anticipated to be complete are the surface soil pathway, soil-to-groundwater pathway, and the groundwater pathway. The church building on the Site is considered a potential sensitive receptor, due to the building's potential use as a day care and/or preschool facility. The proposed community garden is considered a sensitive receptor on the property.

1.2 Purpose

The purpose of this Phase II ESA is to:

- identify if metal contamination attributable to the RSR Corporation Federal Superfund Site is present in on-site soils or groundwater;
- determine if an uncontrolled solid waste dump was present on the Site; and
- determine if hazardous substances related to the Superfund Site and/or the potential uncontrolled solid waste dump are present on the Site and if those substances have released to environmental media.

If the concentrations of hazardous substances are below the applicable TRRP Tier 1 protective concentration levels (PCLs), the TCEQ may issue a no further action (NFA) letter for the Site.

1.3 Problem Definition

An August 1, 2014 Phase I ESA conducted at the Site identified one historical recognized environmental condition (HREC) and one environmental condition relating to the Site. Those conditions are:

- The identified HREC is the possible presence of metal-contaminated soils on-site as a result of aerial deposition from historical activities conducted at the nearby RSR Corporation Federal Superfund Site.

- The environmental condition relating to the Site is suspected use of the Site as a dump prior to current development.

1.4 Project Organization

The project team for the Site comprises the TCEQ project manager (PM), the TCEQ quality assurance (QA) specialist, and the Contractor PM, project QA officer, health and safety officer (H&SO), the data reviewer, and the subcontracted laboratories for this sampling event. The lines of authority and communication for the project are presented in the project organization chart in Figure 1.

In addition to the roles and responsibilities set forth in Element A.4 of the QAPP, the following additional responsibilities are assigned:

The TCEQ Project Manager is responsible for:

- Determining the project data quality objectives (DQOs);
- Planning the project and completing the activities described in this FSP;
- Collecting and documenting the circumstantial information, e.g. photographs, and evidence of owner/operator information available at the Site, to provide information for cost recovery activities, unless delegated to the contractor's PM;
- Preparing of the work order (WO) and necessary amendments;
- Overseeing the activities of the contractor;
- Verifying the work is complete according to the WO, this FSP, and the QAPP;
- Reviewing and approving of contractor invoices, unless delegated otherwise; and
- Distributing the approved FSP, and each addendum, to the TCEQ project personnel on the distribution list.

The TCEQ QA Specialist is responsible for:

- Reviewing and approving the FSP for the project;
- Providing technical assistance to the TCEQ Project Manager in the resolution of QA/QC or analytical chemistry issues; and
- Ensuring the project DQOs and measurement quality objectives (MQOs) were met by the contractor and analytical laboratory.

The Contractor is responsible for:

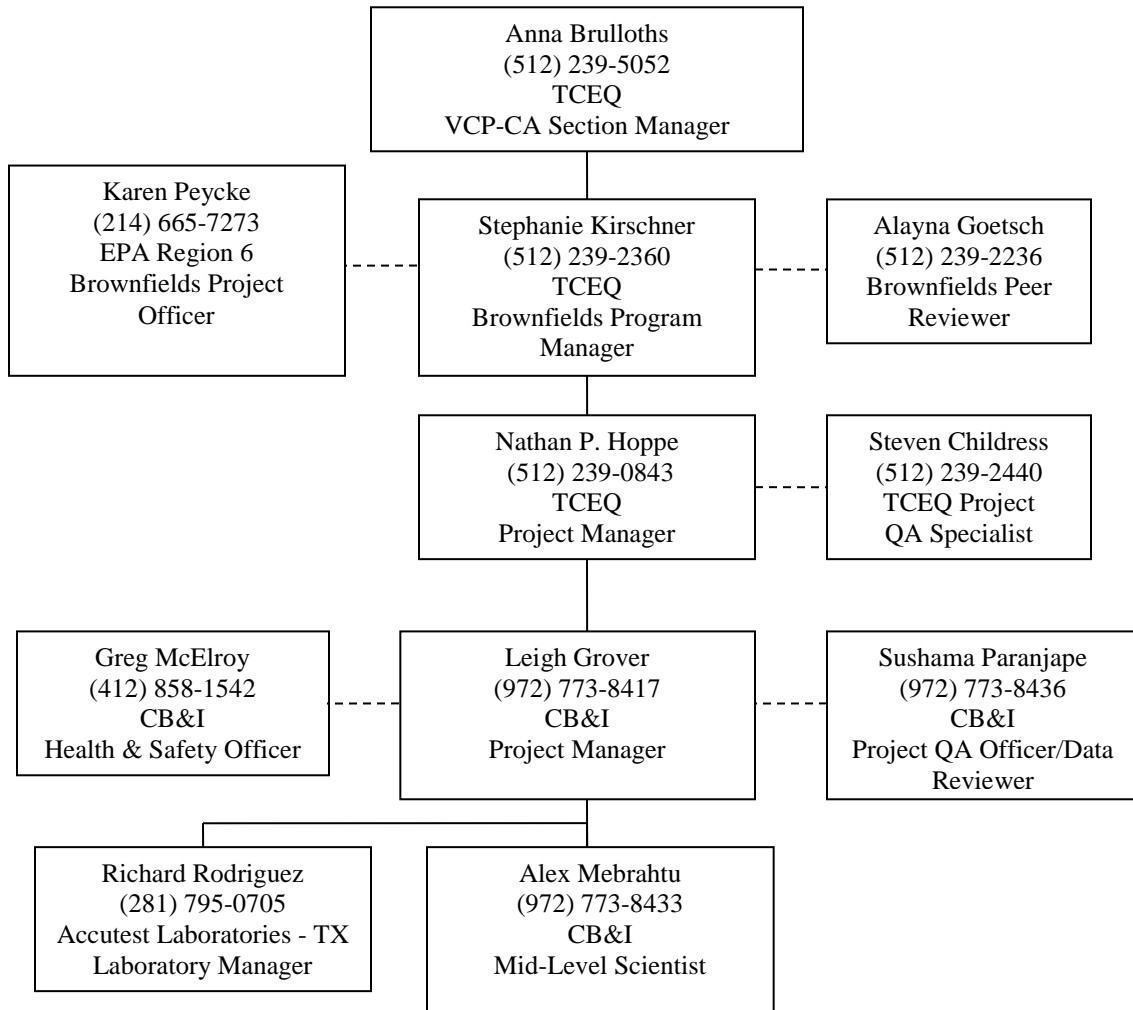
- Distributing the approved FSP, and each addendum, to Contractor personnel and subcontractors responsible for the work performed during this sampling event;
- Securing the signature from the laboratory documenting the laboratory has reviewed the analytical specifications of the FSP and QAPP and can meet the project objectives. The signature can be secure by original hard copy, fax, or by PDF transmittal via electronic mail;

- Performing work, including work performed by the laboratories and all subcontractors, which meets the requirements of the contract, WO and QAPP necessary to fulfill the DQOs;
- Providing appropriate personnel to complete the project within the required timeframe;
- Verifying all on-site personnel adhere to the site-specific Health and Safety Plan (HASP);
- Communicating with the TCEQ PM and following any specific instructions issued;
- Communicating agreed upon changes to the subcontractors;
- Timely submittal of invoices; and
- Determining the type, frequency, and mechanism of communication with subcontractors; the roles and responsibilities of subcontractors; the procedures to monitor subcontractors.

1.5 Schedule of Activities

The sampling event will follow the schedule given in the project schedule in Appendix C of this FSP. If additional work is added by the TCEQ beyond the proposed scope, then the due dates of the project tasks listed in the project schedule will be modified accordingly in the amended schedule. The following tasks related to the collection of environmental samples are:

- Task 1: HASP Preparation and FSP Review.
- Task 2:
 - Mobilize to the site and collect a GPS coordinate for the site;
 - Meet with TCEQ and/or EPA representatives to outline the proposed boundaries (as understood from interviews with property representatives) for the community garden;
 - Install 15 soil borings across three identified sections of the site and collect soil samples following a tiered sampling/analysis system;
 - Install three (3) temporary monitoring wells and collect groundwater samples; and
 - Ship samples to the laboratory.
- Task 3: Review laboratory data and submit data review memorandum and associated analytical data packages.
- Task 4: Prepare and submit the Phase II ESA Report.
- Task 5: Coordinate with landfill for waste disposal classification/acceptance and remove investigation derived waste.

Figure 1 Project Organization Chart

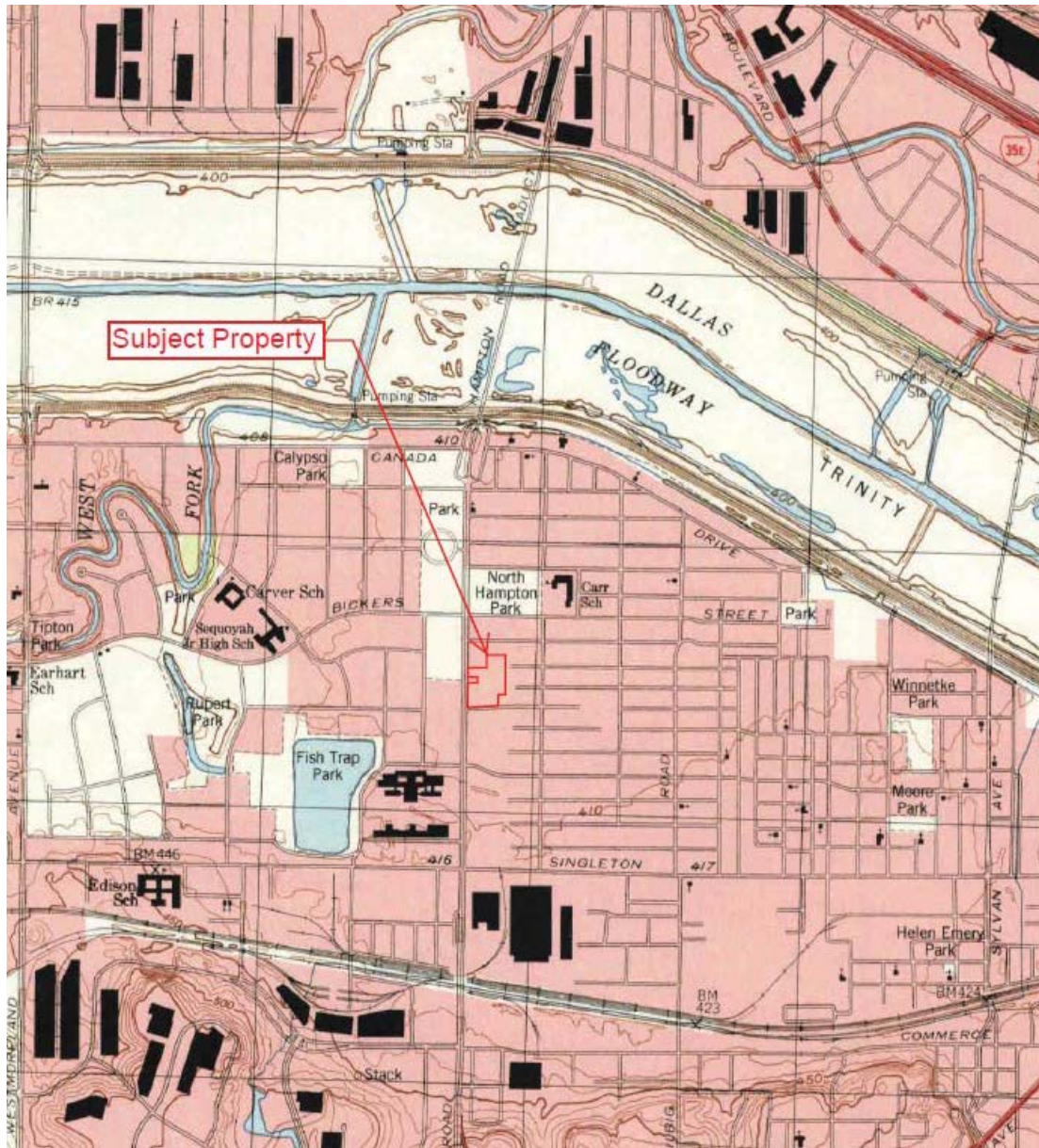


Figure 2 Site Location Map

Texas Commission on Environmental Quality
Dallas West Church of Christ
3400 and 3500 North Hampton Road
Dallas, Texas 75212
Source: USGS Quadrangle: Dallas, TX 1995
Approximate Scale: 1:24,000

2.0 Site and Project Summary

2.1 Site Description and Background

Refer to Section 1.1 for information on the site description and background.

2.2 Previous Investigations

No previous sampling has been conducted on the Site. The August 1, 2014 Phase I ESA identified the RSR Corporation Federal Superfund Site as a HREC and an alleged uncontrolled on-site waste dump as an environmental condition. The location and types of waste disposed is unknown.

2.3 Target Chemicals of Concern

The target chemicals of concern at the site are:

- Antimony
- Arsenic
- Lead
- Cadmium

3.0 Analytical Requirements

3.1 Analytical Requirements and Data Review Requirements

The level of required performance (LORP) is the concentration against which the data will be compared. The analytical results in soil will be compared to the Texas Risk Reduction Program (TRRP) Tier 1 residential 0.5 acre source area PCLs to determine if a release of antimony, arsenic, lead, and cadmium has occurred to the soils at the Site. The analytical results in groundwater will be compared to the Texas Risk Reduction Program (TRRP) Tier 1 residential Class 1 or 2 PCLs to determine if a release of antimony, arsenic, lead, and cadmium has occurred to groundwater at the Site. The LORP for soils is the lower of the total-soil-combined PCL ($PCL_{Tot\ Soil\ Comb}$) and the soil-to-groundwater PCL ($PCL_{GW\ Soil\ Ing}$). However, if the Texas Specific Median Background (TSMB) Concentration is higher than the lowest PCL, then the TSMB Concentration will be used as the LORP for metals in the soils. The LORP for groundwater is the groundwater-to-groundwater ingestion PCL ($PCL_{GW\ GW\ Ing}$). The method quantitation limit (MQL) for the analytical method used should be below the LORP for the target COCs. If the MQL is greater than the LORP, the TCEQ PM will determine if a more sensitive analytical method is needed. If the MQL of the most sensitive analytical method is greater than the LORP, the MQL of that method becomes the LORP. The measurement performance criteria are specified in Element B of the QAPP.

3.1.1 Soil Analytical Requirements

Soil samples will be analyzed for VOCs (SW-846 Methods 5035A/8260C), SVOCs (SW-846 Methods 3550B/8270D), TPH (SW-846 Method 5035A/TCEQ Method 1005), and metals (SW-846 Methods 3050B/6020A). Table(s) 1 through 4 list the target COCs and the LORPs (i.e. the analytical levels of concern) for the soils for this sampling event. Analytes designated as target COCs for this assessment are denoted with an “X.” The TRRP Tier 1 PCLs are taken from the June 29, 2012 TRRP PCL tables.

Table 1 Levels Of Required Performance For VOCs In Soil by SW-846 8260C

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source		Lab MQL (mg/kg)	Is Lab MQL< LORP? (Y/N)
			TotSoil _{Comb} (mg/kg)	GWSoil _{Ing} (mg/kg)		
<input type="checkbox"/>	Acetone (2-propanone)	67-64-1	9800	43	0.010	Y
<input type="checkbox"/>	Benzene	71-43-2	120	0.026	0.00068	Y
<input type="checkbox"/>	Bromobenzene	108-86-1	390	2.3	0.0004	Y
<input type="checkbox"/>	Bromodichloromethane	75-27-4	98	0.065	0.00045	Y
<input type="checkbox"/>	Bromoform	75-25-2	400	0.63	0.00075	Y
<input type="checkbox"/>	Bromomethane (methyl bromide)	74-83-9	46	0.13	0.0019	Y
<input type="checkbox"/>	Butylbenzene, n-	104-51-8	3300	150	0.00044	Y
<input type="checkbox"/>	Butylbenzene, sec-	135-98-8	3300	85	0.00087	Y
<input type="checkbox"/>	Butylbenzene, tert-	98-06-6	3300	100	0.00078	Y
<input type="checkbox"/>	Carbon disulfide	75-15-0	4600	14	0.00058	Y
<input type="checkbox"/>	Carbon tetrachloride	56-23-5	35	0.062	0.00086	Y
<input type="checkbox"/>	Chlorobenzene	108-90-7	17	0.11	0.00093	Y
<input type="checkbox"/>	Chlorobromomethane (bromochloromethane)	74-97-5	3300	3	0.0011	Y
<input type="checkbox"/>	Chloroethane (ethyl chloride)	75-00-3	27000	31	0.0016	Y
<input type="checkbox"/>	Chloroform	67-66-3	16	1	0.00043	Y
<input type="checkbox"/>	Chloromethane (methyl chloride)	74-87-3	140	0.41	0.00077	Y
<input type="checkbox"/>	Chlorotoluene, o- (2- chlorotoluene)	95-49-8	1200	9.1	0.00048	Y
<input type="checkbox"/>	Chlorotoluene, p- (4- chlorotoluene)	106-43-4	1600	11	0.00041	Y
<input type="checkbox"/>	Cumene (isopropylbenzene)	98-82-8	4300	350	0.0011	Y
<input type="checkbox"/>	Cyclohexane	110-82-7	75000	5900	0.0076	Y
<input type="checkbox"/>	Cymene (isopropyltoluene)	99-87-6	8200	230	0.0013	Y
<input type="checkbox"/>	Dibromo-3- chloropropane, 1,2-	96-12-8	0.15	0.0017	0.0032	N
<input type="checkbox"/>	Dibromochloromethane (chlorodibromomethane)	124-48-1	72	0.049	0.00091	Y
<input type="checkbox"/>	Dichlorobenzene, 1,2-	95-50-1	720	18	0.00097	Y

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source		Lab MQL (mg/kg)	Is Lab MQL< LORP? (Y/N)
			TotSoilComb (mg/kg)	GWSoilIng (mg/kg)		
<input type="checkbox"/>	Dichlorobenzene, 1,3-	541-73-1	120	6.7	0.00062	Y
<input type="checkbox"/>	Dichlorobenzene, 1,4-	106-46-7	250	201	0.00086	Y
<input type="checkbox"/>	Dichlorodifluoromethane	75-71-8	1400	240	0.0011	Y
<input type="checkbox"/>	Dichloroethane, 1,1-	75-34-3	11000	18	0.00041	Y
<input type="checkbox"/>	Dichloroethane, 1,2-	107-06-2	11	0.014	0.00048	Y
<input type="checkbox"/>	Dichloroethylene, 1,1-	75-35-4	2300	0.05	0.00042	Y
<input type="checkbox"/>	Dichloroethylene, cis-1,2-	156-59-2	140	0.25	0.00046	Y
<input type="checkbox"/>	Dichloroethylene, trans-1,2	156-60-5	590	0.49	0.00044	Y
<input type="checkbox"/>	Dichloropropane, 1,2-	78-87-5	60	0.023	0.00058	Y
<input type="checkbox"/>	Dichloropropane, 1,3-	142-28-9	36	0.064	0.001	Y
<input type="checkbox"/>	Dichloropropane, 2,2-	594-20-7	61	0.12	0.00054	Y
<input type="checkbox"/>	Dichloropropene, 1,1-	563-58-6	36	0.13	0.00045	Y
<input type="checkbox"/>	Dichloropropene, cis 1,3-	10061-01-5	8	0.0066	0.00045	Y
<input type="checkbox"/>	Dichloropropene, trans 1,3-	10061-02-6	360	0.036	0.00051	Y
<input type="checkbox"/>	Ethyl benzene	100-41-4	6400	7.6	0.00097	Y
<input type="checkbox"/>	Ethylene dibromide (dibromoethane, 1,2-)	106-93-4	0.73	0.00021	0.00042	N
<input type="checkbox"/>	Hexachlorobutadiene	87-68-3	20	3.3	0.00069	Y
<input type="checkbox"/>	Hexanone, 2-	591-78-6	270	0.32	0.0074	Y
<input type="checkbox"/>	Methyl acetate (acetic acid, methyl ester)	79-20-9	82000	49	0.00388	Y
<input type="checkbox"/>	Methyl cyclohexane	108-87-2	41000	16000	0.00137	Y
<input type="checkbox"/>	Methyl ethyl ketone (2-butanone)	78-93-3	40000	29	0.0050	Y
<input type="checkbox"/>	Methyl isobutyl ketone (4-methyl-2-pentanone)	108-10-1	5900	4.9	0.0063	Y
<input type="checkbox"/>	Methylene bromide (dibromomethane)	74-95-3	81	1.1	0.0065	Y
<input type="checkbox"/>	Methylene chloride (dichloromethane)	75-09-2	390	0.013	0.0025	Y
<input type="checkbox"/>	MTBE (methyl tert-butyl ether)	1634-04-4	800	0.62	0.00051	Y
<input type="checkbox"/>	Naphthalene	91-20-3	220	31	0.0020	Y
<input type="checkbox"/>	Propylbenzene, n-	103-65-1	2200	45	0.0010	Y
<input type="checkbox"/>	Styrene	100-42-5	6700	3.3	0.00092	Y
<input type="checkbox"/>	Tetrachloroethane, 1,1,1,2-	630-20-6	65	1.4	0.00050	Y
<input type="checkbox"/>	Tetrachloroethane, 1,1,2,2-	79-34-5	30	0.023	0.0068	Y
<input type="checkbox"/>	Tetrachloroethylene (perchloroethylene)	127-18-4	100	0.050	0.001	Y
<input type="checkbox"/>	Toluene	108-88-3	5900	8.2	0.001	Y
<input type="checkbox"/>	Trichlorobenzene, 1,2,3-	87-61-6	120	26	0.00052	Y
<input type="checkbox"/>	Trichlorobenzene, 1,2,4-	120-82-1	120	4.8	0.00050	Y
<input type="checkbox"/>	Trichloroethane, 1,1,1-	71-55-6	52000	1.6	0.00063	Y
<input type="checkbox"/>	Trichloroethane, 1,1,2-	79-00-5	18	0.02	0.00067	Y

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source		Lab MQL (mg/kg)	Is Lab MQL< LORP? (Y/N)
			TotSoil _{Comb} (mg/kg)	GWSoil _{Ing} (mg/kg)		
<input type="checkbox"/>	Trichloroethylene	79-01-6	120	0.034	0.00047	Y
<input type="checkbox"/>	Trichlorofluoromethane	75-69-4	25000	130	0.00063	Y
<input type="checkbox"/>	Trichloropropane, 1,2,3-	96-18-4	0.20	0.00053	0.00091	N
<input type="checkbox"/>	Trimethylbenzene, 1,2,4-	95-63-6	150	49	0.00050	Y
<input type="checkbox"/>	Trimethylbenzene, 1,3,5-	108-67-8	110	53	0.00094	Y
<input type="checkbox"/>	Vinyl chloride	75-01-4	3.7	0.022	0.00058	Y
<input type="checkbox"/>	Xylene, m-	108-38-3	8900	110	0.0018	Y
<input type="checkbox"/>	Xylene, o-	95-47-6	48000	71	0.0010	Y
<input type="checkbox"/>	Xylene, p-	106-42-3	8900	150	0.0018	Y

Table 2 Levels Of Required Performance For SVOCs In Soil In SW-846 Method 8270D

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source		Lab MQL (mg/kg)	Is Lab MQL <LORP? (Y/N)
			TotSoil _{Comb} (mg/kg)	GWSoil _{ING} (mg/kg)		
<input type="checkbox"/>	Acenaphthene	83-32-9	3000	240	0.048	Y
<input type="checkbox"/>	Acenaphthylene	208-96-8	3800	410	0.045	Y
<input type="checkbox"/>	Acetophenone	98-86-2	6700	8.2	0.037	Y
<input type="checkbox"/>	Anthracene	120-12-7	18000	6900	0.042	Y
<input type="checkbox"/>	Benz-a-anthracene	56-55-3	5.7	18	0.066	Y
<input type="checkbox"/>	Benzaldehyde	100-52-7	8200	11	0.059	Y
<input type="checkbox"/>	Benzo-a-pyrene	50-32-8	0.56	7.6	0.052	Y
<input type="checkbox"/>	Benzo-b-fluoranthene	205-99-2	5.7	60	0.042	Y
<input type="checkbox"/>	Benzo-g,h,i-perylene	191-24-2	1800	46000	0.045	Y
<input type="checkbox"/>	Benzoic acid	65-85-0	270000	190	0.27	Y
<input type="checkbox"/>	Benzo-k-fluoranthene	207-08-9	57	620	0.074	Y
<input type="checkbox"/>	Benzyl alcohol	100-51-6	6700	5.9	0.066	Y
<input type="checkbox"/>	Biphenyl, 1,1-	92-52-4	3300	250	0.055	Y
<input type="checkbox"/>	Bis (2-chloroisopropyl) ether	108-60-1	51	0.19	0.064	Y
<input type="checkbox"/>	Bis (2-ethyl-hexyl) phthalate	117-81-7	43	160	0.13	Y
<input type="checkbox"/>	Bromophenyl phenylether, 4-	101-55-3	0.28	0.35	0.051	Y
<input type="checkbox"/>	Butyl benzyl phthalate	85-68-7	1600	260	0.054	Y
<input type="checkbox"/>	Caprolactam	105-60-2	33000	47	0.054	Y
<input type="checkbox"/>	Carbazole	86-74-8	230	4.6	0.053	Y
<input type="checkbox"/>	Chloro-3-methylphenol, 4-	59-50-7	330	4.5	0.063	Y
<input type="checkbox"/>	Chloronaphthalene, 2- (chloronaphthalene,	91-58-7	5000	670	0.049	Y

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source		Lab MQL (mg/kg)	Is Lab MQL <LORP? (Y/N)
			Tot Soil _{Comb} (mg/kg)	GW Soil _{ING} (mg/kg)		
	beta)					
<input type="checkbox"/>	Chlorophenol, 2-	95-57-8	410	1.6	0.072	Y
<input type="checkbox"/>	Chrysene	218-01-9	560	1500	0.071	Y
<input type="checkbox"/>	Cresol, o- (2-methylphenol)	95-48-7	3300	7.1	0.073	Y
<input type="checkbox"/>	Cresol, p- (4-methylphenol)	106-44-5	330	0.63	0.072	Y
<input type="checkbox"/>	Dibenz-a,h-anthracene	53-70-3	0.55	15	0.058	Y
<input type="checkbox"/>	Dibenzofuran	132-64-9	270	33	0.055	Y
<input type="checkbox"/>	Dichlorophenol, 2,4-	120-83-2	200	0.35	0.053	Y
<input type="checkbox"/>	Diethyl phthalate	84-66-2	53000	160	0.049	Y
<input type="checkbox"/>	Dimethyl phenol, 2,4-	105-67-9	1300	3.2	0.057	Y
<input type="checkbox"/>	Dimethylphthalate	131-11-3	53000	62	0.048	Y
<input type="checkbox"/>	Di-n-butyl phthalate	84-74-2	6200	3300	0.053	Y
<input type="checkbox"/>	Di-n-octyl phthalate	117-84-0	2600	1000000	0.044	Y
<input type="checkbox"/>	Fluoranthene	206-44-0	2300	1900	0.055	Y
<input type="checkbox"/>	Fluorene	86-73-7	2300	300	0.05	Y
<input type="checkbox"/>	Hexachlorobenzene	118-74-1	1.1	1.1	0.054	Y
<input type="checkbox"/>	Hexachlorobutadiene	87-68-3	20	3.3	0.061	Y
<input type="checkbox"/>	Hexachlorocyclopentadiene (HCCPD)	77-47-4	14	19	0.079	Y
<input type="checkbox"/>	Hexachloroethane	67-72-1	67	1.8	0.061	Y
<input type="checkbox"/>	Indeno-1,2,3-cd-pyrene	193-39-5	5.7	170	0.061	Y
<input type="checkbox"/>	Isophorone	78-59-1	4900	3	0.051	Y
<input type="checkbox"/>	Methylnaphthalene, 2-	91-57-6	250	17	0.063	Y
<input type="checkbox"/>	Naphthalene	91-20-3	220	31	0.06	Y
<input type="checkbox"/>	Nitroaniline, 4-	100-01-6	220	0.11	0.055	Y
<input type="checkbox"/>	Nitrobenzene	98-95-3	66	0.35	0.048	Y
<input type="checkbox"/>	Nitrophenol, 2-	88-75-5	130	0.13	0.057	Y
<input type="checkbox"/>	Nitrophenol, 4-	100-02-7	130	0.1	0.047	Y
<input type="checkbox"/>	Nitrosodiphenylamine, N-	86-30-6	570	2.8	0.047	Y
<input type="checkbox"/>	Phenanthrene	85-01-8	1700	420	0.047	Y
<input type="checkbox"/>	Phenol	108-95-2	20000	19	0.076	Y
<input type="checkbox"/>	Pyrene	129-00-0	1700	1100	0.075	Y
<input type="checkbox"/>	Trichlorophenol, 2,4,5-	95-95-4	6700	34	0.052	Y
<input type="checkbox"/>	Trichlorophenol, 2,4,6-	88-06-2	67	0.17	0.044	Y

**Table 3 Levels Of Required Performance For TPH In Soil TCEQ
Method 1005**

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source		Lab MQL (mg/kg)	Is Lab MQL < LORP? (Y/N)
			Tot Soil _{Comb} (mg/kg)	GW Soil _{ING} (mg/kg)		

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source		Lab MQL (mg/kg)	Is Lab MQL < LORP? (Y/N)
			Tot ^{Soil} Comb (mg/kg)	GW ^{Soil} ING (mg/kg)		
<input type="checkbox"/>	C6-C12 TPH Soil	TPH-1005-1	1600	65	11	Y
<input type="checkbox"/>	>C12-C28 TPH Soil	TPH-1005-2	2300	200	14	Y
<input type="checkbox"/>	>C12-C35 TPH Soil	TPH-1005-3	2300	200	14	Y
<input type="checkbox"/>	>C28-C35 TPH Soil	TPH-1005-4	2300	200	11	Y

Table 4 Levels Of Required Performance For Metals In Soil by SW-846 Methods 6020A

Target COC	Analyte	CAS No.	TRRP Residential PCL 0.5 Acre Source			Texas-Specific Soil Background Concentrations (mg/kg)	Lab MQL (mg/kg)	Is Lab MQL < LORP? (Y/N)
			Tot ^{Soil} Comb (mg/kg)	GW ^{Soil} Ing (mg/kg)	Tier 1 ^{GW} Soil for Secondary MCL (mg/kg)			
<input checked="" type="checkbox"/>	Antimony	7440-36-0	15	5.4	---	1	0.004	Y
<input checked="" type="checkbox"/>	Arsenic	7440-38-2	24	5.0	---	5.9	0.004	Y
<input type="checkbox"/>	Barium	7440-39-3	8100	440	---	300	0.017	Y
<input type="checkbox"/>	Beryllium	7440-41-7	38	1.8	---	1.5	0.003	Y
<input checked="" type="checkbox"/>	Cadmium	7440-43-9	52	1.5	---	---	0.004	Y
<input type="checkbox"/>	Chromium (total)	7440-47-3	33000	2400	---	30	0.008	Y
<input type="checkbox"/>	Copper	7440-50-8	550	1000	800	15	0.012	Y
<input checked="" type="checkbox"/>	Lead (inorganic)	7439-92-1	500	3.0	---	15	0.007	Y
<input type="checkbox"/>	Manganese	7439-96-5	3700	1200	50	300	0.025	Y
<input type="checkbox"/>	Nickel and compounds	7440-02-0	840	160	---	10	0.007	Y
<input type="checkbox"/>	Silver	7440-22-4	97	0.48	0.39	---	0.004	Y
<input type="checkbox"/>	Zinc	7440-66-6	9900	2400	1600	30	0.032	Y

3.1.2 Groundwater Analytical Requirements

Groundwater samples will be analyzed for VOCs (SW-846 Methods 5030B/8260C), SVOCs (SW-846 Methods 3510C/8270D), TPH (TCEQ Method 1005), and metals (SW-846 Methods 3010A/6020A). Table(s) 5 through 8 list the target COCs and the LORPs (i.e. the analytical levels of concern) in the groundwater for this sampling event. Analytes designated target COCs for this assessment are denoted with an “X.” The TRRP Tier 1 PCLs are taken from the June 29, 2012 TRRP PCL tables.

Table 5 Levels Of Required Performance For VOCs In Groundwater by SW-846 Method 8260C

Target COC	Analyte	CAS No.	TRRP Residential PCL GW ^{GW} Ing (mg/L)	Lab MQL (mg/L)	Is Lab MQL < LORP? (Y/N)
<input type="checkbox"/>	Acetone (2-propanone)	67-64-1	22	0.01	Y
<input type="checkbox"/>	Benzene	71-43-2	0.005	0.00034	Y
<input type="checkbox"/>	Bromobenzene	108-86-1	0.20	0.00029	Y
<input type="checkbox"/>	Bromodichloromethane	75-27-4	0.015	0.00034	Y
<input type="checkbox"/>	Bromoform	75-25-2	0.12	0.00044	Y
<input type="checkbox"/>	Bromomethane (methyl bromide)	74-83-9	0.034	0.00051	Y
<input type="checkbox"/>	Butylbenzene, n-	104-51-8	1.20	0.00039	Y
<input type="checkbox"/>	Butylbenzene, sec-	135-98-8	0.98	0.00045	Y
<input type="checkbox"/>	Butylbenzene, tert-	98-06-6	0.98	0.00045	Y
<input type="checkbox"/>	Carbon disulfide	75-15-0	2.4	0.00036	Y
<input type="checkbox"/>	Carbon tetrachloride	56-23-5	0.005	0.00043	Y
<input type="checkbox"/>	Chlorobenzene	108-90-7	0.1	0.00027	Y
<input type="checkbox"/>	Chlorobromomethane (bromochloromethane)	74-97-5	0.98	0.00042	Y
<input type="checkbox"/>	Chloroethane (ethyl chloride)	75-00-3	9.8	0.00072	Y
<input type="checkbox"/>	Chloroform	67-66-3	0.24	0.00035	Y
<input type="checkbox"/>	Chloromethane (methyl chloride)	74-87-3	0.07	0.00063	Y
<input type="checkbox"/>	Chlorotoluene, o- (2- chlorotoluene)	95-49-8	0.49	0.00036	Y
<input type="checkbox"/>	Chlorotoluene, p- (4- chlorotoluene)	106-43-4	0.49	0.00031	Y
<input type="checkbox"/>	Cumene (isopropylbenzene)	98-82-8	2.4	0.0004	Y
<input type="checkbox"/>	Cyclohexane	110-82-7	120	0.00056	Y
<input type="checkbox"/>	Cymene (isopropyltoluene)	99-87-6	2.4	0.00036	Y
<input type="checkbox"/>	Dibromo-3-chloropropane, 1,2-	96-12-8	0.0002	0.0016	N
<input type="checkbox"/>	Dibromochloromethane (chlorodibromomethane)	124-48-1	0.011	0.00034	Y
<input type="checkbox"/>	Dichlorobenzene, 1,2-	95-50-1	0.6	0.00028	Y
<input type="checkbox"/>	Dichlorobenzene, 1,3-	541-73-1	0.73	0.00033	Y
<input type="checkbox"/>	Dichlorobenzene, 1,4-	106-46-7	0.075	0.00032	Y
<input type="checkbox"/>	Dichlorodifluoromethane	75-71-8	4.9	0.0015	Y
<input type="checkbox"/>	Dichloroethane, 1,1-	75-34-3	4.9	0.00034	Y
<input type="checkbox"/>	Dichloroethane, 1,2-	107-06-2	0.005	0.00035	Y
<input type="checkbox"/>	Dichloroethylene, 1,1-	75-35-4	0.007	0.00045	Y
<input type="checkbox"/>	Dichloroethylene, cis-1,2-	156-59-2	0.07	0.0004	Y
<input type="checkbox"/>	Dichloroethylene, trans-1,2	156-60-5	0.1	0.00047	Y
<input type="checkbox"/>	Dichloropropane, 1,2-	78-87-5	0.005	0.00033	Y
<input type="checkbox"/>	Dichloropropane, 1,3-	142-28-9	0.0091	0.00032	Y
<input type="checkbox"/>	Dichloropropane, 2,2-	594-20-7	0.013	0.00051	Y
<input type="checkbox"/>	Dichloropropene, 1,1-	563-58-6	0.0091	0.00062	Y
<input type="checkbox"/>	Dichloropropene, cis 1,3-	10061-01-5	0.0017	0.00029	Y
<input type="checkbox"/>	Dichloropropene, trans 1,3-	10061-02-6	0.0091	0.00032	Y
<input type="checkbox"/>	Ethyl benzene	100-41-4	0.7	0.00032	Y
<input type="checkbox"/>	Ethylene dibromide (dibromoethane, 1,2-)	106-93-4	0.00005	0.00034	N
<input type="checkbox"/>	Hexachlorobutadiene	87-68-3	0.012	0.00049	Y

Target COC	Analyte	CAS No.	TRRP Residential PCL GW ^{GW} Ing (mg/L)	Lab MQL (mg/L)	Is Lab MQL < LORP? (Y/N)
<input type="checkbox"/>	Hexanone, 2-	591-78-6	0.12	0.0026	Y
<input type="checkbox"/>	Methyl acetate (acetic acid, methyl ester)	79-20-9	24	0.00219	Y
<input type="checkbox"/>	Methyl cyclohexane	108-87-2	120	0.00065	Y
<input type="checkbox"/>	Methyl ethyl ketone (2- butanone)	78-93-3	15	0.0027	Y
<input type="checkbox"/>	Methyl isobutyl ketone (4- methyl-2-pentanone)	108-10-1	2.0	0.0022	Y
<input type="checkbox"/>	Methylene bromide (dibromomethane)	74-95-3	0.12	0.00045	Y
<input type="checkbox"/>	Methylene chloride (dichloromethane)	75-09-2	0.005	0.0016	Y
<input type="checkbox"/>	MTBE (methyl tert-butyl ether)	1634-04-4	0.24	0.0003	Y
<input type="checkbox"/>	Naphthalene	91-20-3	0.49	0.0016	Y
<input type="checkbox"/>	Propylbenzene, n-	103-65-1	0.98	0.00035	Y
<input type="checkbox"/>	Styrene	100-42-5	0.1	0.00029	Y
<input type="checkbox"/>	Tetrachloroethane, 1,1,1,2-	630-20-6	0.035	0.00037	Y
<input type="checkbox"/>	Tetrachloroethane, 1,1,2,2-	79-34-5	0.0046	0.0004	Y
<input type="checkbox"/>	Tetrachloroethylene (perchloroethylene)	127-18-4	0.005	0.00046	Y
<input type="checkbox"/>	Toluene	108-88-3	1.0	0.00033	Y
<input type="checkbox"/>	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	730	0.00075	Y
<input type="checkbox"/>	Trichlorobenzene, 1,2,3-	87-61-6	0.073	0.00042	Y
<input type="checkbox"/>	Trichlorobenzene, 1,2,4-	120-82-1	0.07	0.00041	Y
<input type="checkbox"/>	Trichloroethane, 1,1,1-	71-55-6	0.20	0.00043	Y
<input type="checkbox"/>	Trichloroethane, 1,1,2-	79-00-5	0.005	0.00035	Y
<input type="checkbox"/>	Trichloroethylene	79-01-6	0.005	0.00049	Y
<input type="checkbox"/>	Trichlorofluoromethane	75-69-4	7.3	0.00075	Y
<input type="checkbox"/>	Trichloropropane, 1,2,3-	96-18-4	0.00003	0.00046	N
<input type="checkbox"/>	Trimethylbenzene, 1,2,4-	95-63-6	1.22	0.00032	Y
<input type="checkbox"/>	Trimethylbenzene, 1,3,5-	108-67-8	1.2	0.00035	Y
<input type="checkbox"/>	Vinyl chloride	75-01-4	0.002	0.00079	Y
<input type="checkbox"/>	Xylene, m-	108-38-3	10	0.00059	Y
<input type="checkbox"/>	Xylene, o-	95-47-6	10	0.00028	Y
<input type="checkbox"/>	Xylene, p-	106-42-3	10	0.00059	Y

**Table 6 Levels Of Required Performance For SVOCs In Groundwater
by SW-846 Method 8270D**

Target COC	Analyte	CAS No.	TRRP Residential PCL ^{gw} GW _{ing} (mg/L)	Lab MQL (mg/L)	Is Lab MQL < LORP? (Y/N)
<input type="checkbox"/>	Acenaphthene	83-32-9	1.5	0.0012	Y
<input type="checkbox"/>	Acenaphthylene	208-96-8	1.5	0.0012	Y
<input type="checkbox"/>	Acetophenone	98-86-2	2.4	0.0015	Y
<input type="checkbox"/>	Anthracene	120-12-7	7.3	0.0014	Y
<input type="checkbox"/>	Atrazine	1912-24-9	0.003	0.00279	Y
<input type="checkbox"/>	Benz-a-anthracene	56-55-3	0.0013	0.0015	N
<input type="checkbox"/>	Benzaldehyde	100-52-7	2.4	0.00234	Y
<input type="checkbox"/>	Benzo-a-pyrene	50-32-8	0.0002	0.0013	N
<input type="checkbox"/>	Benzo-b-fluoranthene	205-99-2	0.0013	0.0012	Y
<input type="checkbox"/>	Benzo-g,h,i-perylene	191-24-2	0.73	0.0015	Y
<input type="checkbox"/>	Benzoic acid	65-85-0	98	0.01	Y
<input type="checkbox"/>	Benzo-k-fluoranthene	207-08-9	0.013	0.0015	Y
<input type="checkbox"/>	Benzyl alcohol	100-51-6	2.4	0.00088	Y
<input type="checkbox"/>	Biphenyl, 1,1-	92-52-4	1.2	0.00138	Y
<input type="checkbox"/>	Bis (2-chloroethoxy) methane	111-91-1	0.00083	0.0012	N
<input type="checkbox"/>	Bis (2-chloroethyl) ether	111-44-4	0.00083	0.00095	N
<input type="checkbox"/>	Bis (2-chloroisopropyl) ether	108-60-1	0.013	0.0009	Y
<input type="checkbox"/>	Bis (2-ethyl-hexyl) phthalate	117-81-7	0.006	0.0015	Y
<input type="checkbox"/>	Bromophenyl phenylether, 4-	101-55-3	0.000061	0.0012	N
<input type="checkbox"/>	Butyl benzyl phthalate	85-68-7	0.48	0.0013	Y
<input type="checkbox"/>	Caprolactam	105-60-2	12	0.00189	Y
<input type="checkbox"/>	Carbazole	86-74-8	0.046	0.0014	Y
<input type="checkbox"/>	Chloro-3-methylphenol, 4-	59-50-7	0.12	0.0012	Y
<input type="checkbox"/>	Chloroaniline, p-	106-47-8	0.0046	0.0011	Y
<input type="checkbox"/>	Chloronaphthalene, 2- (chloronaphthalene, beta)	91-58-7	2.0	0.0013	Y
<input type="checkbox"/>	Chlorophenol, 2-	95-57-8	0.12	0.00096	Y
<input type="checkbox"/>	Chlorophenyl phenylether, 4-	7005-72-3	0.000061	0.0013	N
<input type="checkbox"/>	Chrysene	218-01-9	0.13	0.0016	Y
<input type="checkbox"/>	Cresol, o- (2-methylphenol)	95-48-7	1.2	0.00096	Y
<input type="checkbox"/>	Cresol, p- (4-methylphenol)	106-44-5	0.12	0.0011	Y
<input type="checkbox"/>	Dibenz-a,h-anthracene	53-70-3	0.0002	0.0014	N
<input type="checkbox"/>	Dibenzofuran	132-64-9	0.098	0.0013	Y
<input type="checkbox"/>	Dichlorobenzidine, 3,3-	91-94-1	0.002	0.0013	Y
<input type="checkbox"/>	Dichlorophenol, 2,4-	120-83-2	0.073	0.0011	Y
<input type="checkbox"/>	Diethyl phthalate	84-66-2	20	0.0014	Y
<input type="checkbox"/>	Dimethyl phenol, 2,4-	105-67-9	0.49	0.0011	Y
<input type="checkbox"/>	Dimethylphthalate	131-11-3	20	0.0014	Y
<input type="checkbox"/>	Di-n-butyl phthalate	84-74-2	2.4	0.0013	Y
<input type="checkbox"/>	Dinitro-2-methylphenol, 4,6- (dinitro-o-cresol, 4, 6-)	534-52-1	0.0024	0.0055	N
<input type="checkbox"/>	Dinitrophenol, 2,4-	51-28-5	0.049	0.01	Y
<input type="checkbox"/>	Dinitrotoluene, 2,4-	121-14-2	0.0013	0.0013	N
<input type="checkbox"/>	Dinitrotoluene, 2,6-	606-20-2	0.0013	0.001	Y
<input type="checkbox"/>	Di-n-octyl phthalate	117-84-0	0.49	0.0012	Y
<input type="checkbox"/>	Fluoranthene	206-44-0	0.98	0.0014	Y
<input type="checkbox"/>	Fluorene	86-73-7	0.98	0.0012	Y

Target COC	Analyte	CAS No.	TRRP Residential PCL ^{gw} GW_{Ing} (mg/L)	Lab MQL (mg/L)	Is Lab MQL < LORP? (Y/N)
<input type="checkbox"/>	Hexachlorobenzene	118-74-1	0.001	0.0016	N
<input type="checkbox"/>	Hexachlorobutadiene	87-68-3	0.012	0.0012	Y
<input type="checkbox"/>	Hexachlorocyclopentadiene (HCCPD)	77-47-4	0.05	0.0012	Y
<input type="checkbox"/>	Hexachloroethane	67-72-1	0.024	0.0013	Y
<input type="checkbox"/>	Indeno-1,2,3-cd-pyrene	193-39-5	0.0013	0.001	Y
<input type="checkbox"/>	Isophorone	78-59-1	0.96	0.0012	Y
<input type="checkbox"/>	Methylnaphthalene, 2-	91-57-6	0.098	0.0011	Y
<input type="checkbox"/>	Naphthalene	91-20-3	0.49	0.001	Y
<input type="checkbox"/>	Nitroaniline, 2-	88-74-4	0.0073	0.0013	Y
<input type="checkbox"/>	Nitroaniline, 3-	99-09-2	0.0073	0.0012	Y
<input type="checkbox"/>	Nitroaniline, 4-	100-01-6	0.046	0.0014	Y
<input type="checkbox"/>	Nitrobenzene	98-95-3	0.049	0.0012	Y
<input type="checkbox"/>	Nitrophenol, 2-	88-75-5	0.049	0.0011	Y
<input type="checkbox"/>	Nitrophenol, 4-	100-02-7	0.049	0.0072	Y
<input type="checkbox"/>	Nitrosodi-n-propylamine, N-	621-64-7	0.00013	0.0011	N
<input type="checkbox"/>	Nitrosodiphenylamine, N-	86-30-6	0.19	0.001	Y
<input type="checkbox"/>	Pentachlorophenol	87-86-5	0.001	0.01	N
<input type="checkbox"/>	Phenanthrene	85-01-8	0.73	0.0015	Y
<input type="checkbox"/>	Phenol	108-95-2	7.3	0.0015	Y
<input type="checkbox"/>	Pyrene	129-00-0	0.73	0.0014	Y
<input type="checkbox"/>	Trichlorophenol, 2,4,5-	95-95-4	2.4	0.00098	Y
<input type="checkbox"/>	Trichlorophenol, 2,4,6-	88-06-2	0.024	0.0011	Y

**Table 7 Levels Of Required Performance For TPH In Groundwater by
TCEQ Method 1005**

Target COC	Analyte	CAS No.	TRRP Residential PCL ^{gw} GW_{Ing} (mg/L)	Lab MQL (mg/L)	Is Lab MQL < LORP? (Y/N)
<input type="checkbox"/>	C6-C12 TPH Water	TPH-1005-1	0.98	0.59	Y
<input type="checkbox"/>	>C12-C28 TPH Water	TPH-1005-2	0.98	0.85	Y
<input type="checkbox"/>	>C12-C35 TPH Water	TPH-1005-3	0.98	0.85	Y
<input type="checkbox"/>	>C28-C35 TPH Water	TPH-1005-4	0.98	0.59	Y

**Table 8 Levels Of Required Performance For Metals In Groundwater
by SW-846 Methods 6020A**

Target COC	Analyte	CAS No.	TRRP Residential PCL GW _{GW_{Ing}} (mg/L)	Lab MQL (mg/L)	Is Lab MQL < LORP? (Y/N)
<input checked="" type="checkbox"/>	Antimony	7440-36-0	0.006	0.00036	Y
<input checked="" type="checkbox"/>	Arsenic	7440-38-2	0.01	0.00026	Y
<input type="checkbox"/>	Barium	7440-39-3	2.0	0.000093	Y
<input type="checkbox"/>	Beryllium	7440-41-7	0.004	0.00013	Y
<input checked="" type="checkbox"/>	Cadmium	7440-43-9	0.005	0.00014	Y
<input type="checkbox"/>	Chromium (total)	7440-47-3	0.1	0.000066	Y
<input type="checkbox"/>	Copper	7440-50-8	1.3	0.000057	Y
<input checked="" type="checkbox"/>	Lead (inorganic)	7439-92-1	0.015	0.00024	Y
<input type="checkbox"/>	Manganese	7439-96-5	1.1	0.001	Y
<input type="checkbox"/>	Nickel and compounds	7440-02-0	0.49	0.00005	Y
<input type="checkbox"/>	Silver	7440-22-4	0.12	0.0001	Y
<input type="checkbox"/>	Zinc	7440-66-6	7.3	0.00041	Y

3.1.3 Data Review

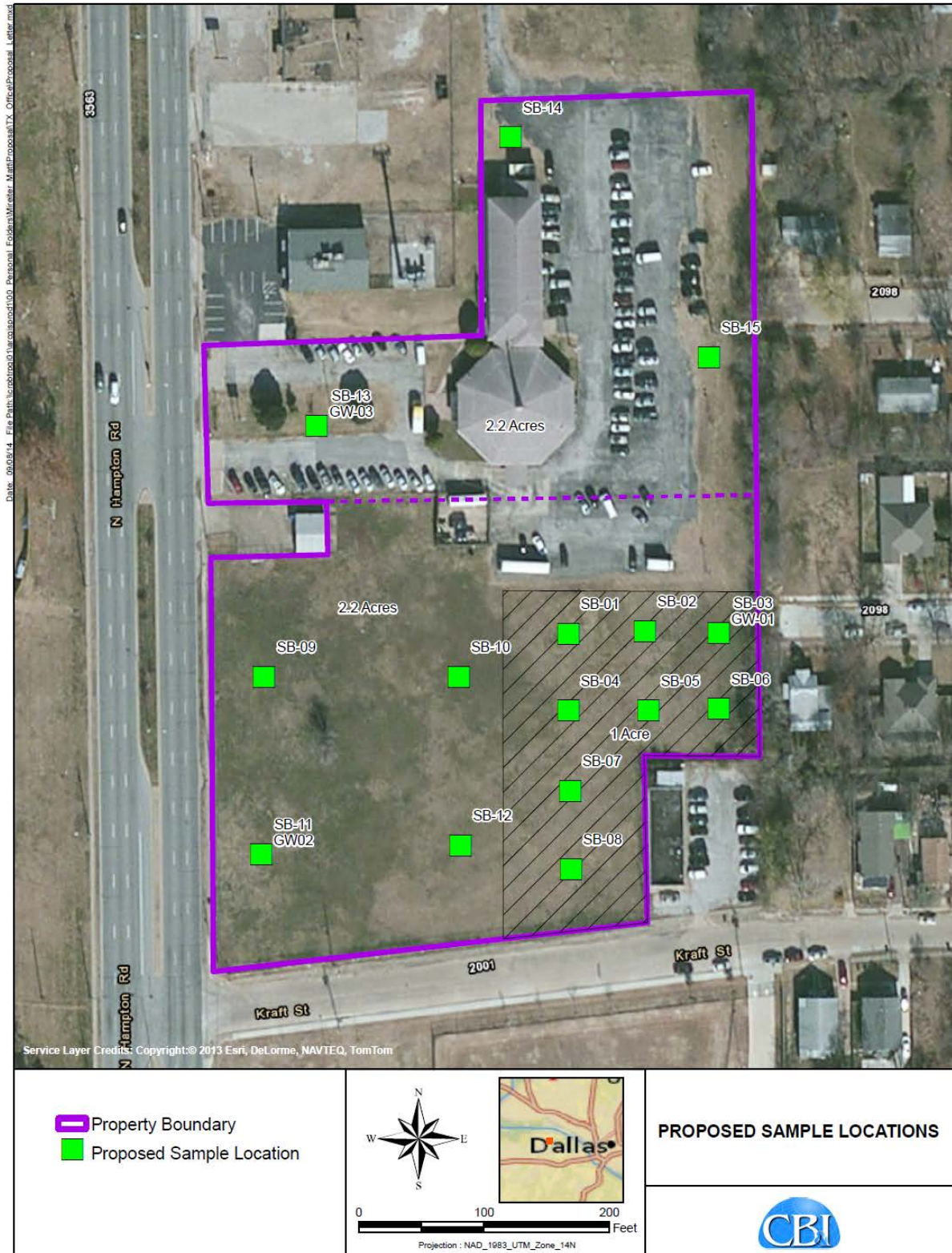
The laboratory will provide the contractor with an electronic data deliverable (EDD) that contains all pertinent information per contract specifications.

The laboratory shall review the data as specified in QAPP Element D.2.1.1 and shall submit the data package as specified in QAPP Element A.9.2. The independent data usability review shall be completed by the contractor as specified in QAPP Element D.2.1.2.

3.1.4 Data Review Memorandum

The data review memorandum shall be completed pursuant to the contract requirements.

Figure 3 Proposed Sample Location Map



Note: The hatched line area in the southeast corner of the site is the proposed community garden.

4.0 Sampling Plan Design

The sampling design is judgmental, i.e. not statistical. Sample locations are selected to determine concentrations of the target COCs in background areas, in areas of known or suspected releases, in known or suspected migration pathways, and in known or suspected sources.

4.1 Sampling Locations and Rationale

The planned sample locations are indicated in Figure 3, Sample Location Map. The rationale for each sample location is presented in Table 9. Because the sampling plan is based on judgment, all of the samples listed in Table 9 are critical by location.

Table 9 Sample Rationale, Locations, and Analyses

Sample ID	Sample Location (and depth if applicable)	Sample Rationale (including associated field QC samples)	Analysis*
<i>Surface Soil Samples</i>			
SB-01 through SB-08	<p>Eight (8) borings within the surveyed one (1) acre tract of land within Lot 4 will be collected on a 1/8 acre grid.</p> <p>Borings will be advanced to a maximum depth of five (5) feet below ground surface (bgs).</p>	<p>Samples will be collected at 0-0.5 ft. bgs, 2.5-3 ft. bgs, and 4.5-5 ft. bgs. Samples collected from 0-0.5 ft. bgs will be analyzed for metals. The samples collected at greater depths will be analyzed for metals only if the 0-0.5 ft. bgs sample shows concentrations of metal COCs above the applicable TRRP Tier 1 residential PCLs. In addition, the soil samples obtained from each boring will be screened for organics with a photoionization detector (PID) field instrument. For each soil boring, the soil interval exhibiting the highest PID reading will be analyzed for VOCs, SVOCs, and TPH. If none of the soil samples collected from a given soil boring gives a positive PID reading, the samples will not be analyzed for VOCs, SVOCs, and TPH.</p>	1, 2, 3, 4
SB-09 through SB-12	<p>Four (4) borings will be advanced in the remaining 2.21 acres of Lot 4. They will be collected on a 1/2 acre grid.</p> <p>Borings will be advanced to a maximum depth of</p>	<p>Samples will be collected at 0-0.5 ft. bgs, 2.5-3 ft. bgs, and 4.5-5 ft. bgs. Samples collected from 0-0.5 ft. bgs will be analyzed for metals. The samples collected at greater depths will be analyzed for metals only if the 0-0.5 ft. bgs sample shows concentrations of metal COCs above the applicable TRRP</p>	1, 2, 3, 4

Sample ID	Sample Location (and depth if applicable)	Sample Rationale (including associated field QC samples)	Analysis*
	five (5) feet below ground surface (bgs).	Tier 1 residential PCLs. In addition, the soil samples obtained from each boring will be screened for organics with a PID field instrument. For each soil boring, the soil interval exhibiting the highest PID reading will be analyzed for VOCs, SVOCs, and TPH. If none of the soil samples collected from a given soil boring give a positive PID reading, the samples will not be analyzed for VOCs, SVOCs, and TPH.	
SB-13	<p>West side of Lot 3 in the divided drive way entrance to the church parking lot.</p> <p>The boring will be advanced to a maximum depth of five (5) feet below ground surface (bgs).</p>	<p>Samples will be collected at 0-0.5 ft. bgs, 2.5-3 ft. bgs, and 4.5-5 ft. bgs. Samples collected from 0-0.5 ft. bgs will be analyzed for metals. The samples collected at greater depths will be analyzed for metals only if the 0-0.5 ft. bgs sample shows concentrations of metal COCs above the applicable TRRP Tier 1 residential PCLs. In addition, the soil samples obtained from each boring will be screened for organics with a PID field instrument. For each soil boring, the soil interval exhibiting the highest PID reading will be analyzed for VOCs, SVOCs, and TPH. If none of the soil samples collected from a given soil boring give a positive PID reading, the samples will not be analyzed for VOCs, SVOCs, and TPH.</p>	1, 2, 3, 4
SB-14	<p>North side of Lot 3, specifically, north of the church building and to the west of the parking lot.</p> <p>The boring will be advanced to a maximum depth of five (5) feet below ground surface (bgs).</p>	<p>Samples will be collected at 0-0.5 ft. bgs, 2.5-3 ft. bgs, and 4.5-5 ft. bgs. Samples collected from 0-0.5 ft. bgs will be analyzed for metals. The samples collected at greater depths will be analyzed for metals only if the 0-0.5 ft. bgs sample shows concentrations of metal COCs above the applicable TRRP Tier 1 residential PCLs. In addition, the soil samples obtained from each boring will be screened for</p>	1, 2, 3, 4

Sample ID	Sample Location (and depth if applicable)	Sample Rationale (including associated field QC samples)	Analysis*
		organics with a PID field instrument. For each soil boring, the soil interval exhibiting the highest PID reading will be analyzed for VOCs, SVOCs, and TPH. If none of the soil samples collected from a given soil boring give a positive PID reading, the samples will not be analyzed for VOCs, SVOCs, and TPH.	
SB-15	<p>East side of Lot 3, specifically, in between the property boundary and the east side of the parking lot.</p> <p>The boring will be advanced to a maximum depth of five (5) feet below ground surface (bgs).</p>	Samples will be collected at 0-0.5 ft. bgs, 2.5-3 ft. bgs, and 4.5-5 ft. bgs. Samples collected from 0-0.5 ft. bgs will be analyzed for metals. The samples collected at greater depths will be analyzed for metals only if the 0-0.5 ft. bgs sample shows concentrations of metal COCs above the applicable TRRP Tier 1 residential PCLs. In addition, the soil samples obtained from each boring will be screened for organics with a PID field instrument. For each soil boring, the soil interval exhibiting the highest PID reading will be analyzed for VOCs, SVOCs, and TPH. If none of the soil samples collected from a given soil boring give a positive PID reading, the samples will not be analyzed for VOCs, SVOCs, and TPH.	1, 2, 3, 4
SB-16	SB-01	Field duplicate of SB-01, 0-0.5 foot sample.	1, 2, 3, 4
SB-17	SB-07	Field duplicate of SB-07, 0-0.5 foot sample.	1, 2, 3, 4
SB-18	SB-09	Field duplicate of SB-09, 0-0.5 foot sample.	1, 2, 3, 4
SB-19	SB-14	Field duplicate of SB-14, 0-0.5 foot sample.	1, 2, 3, 4
Groundwater Samples			
GW-01	SB-03 will be converted to GW-01 which is one of the eight soil borings surveyed one (1) acre of land in Lot 4 will be converted into a	Assessing the groundwater from the monitor wells.	1, 2, 3, 4

Sample ID	Sample Location (and depth if applicable)	Sample Rationale (including associated field QC samples)	Analysis*
	temporary monitoring well. Groundwater is expected to be encountered at 10-30 feet bgs.		
GW-02	SB-11, one of the four (4) soil borings within the remaining 2.21 acres of Lot 4 will be converted into a temporary monitoring well.	Assessing the groundwater from the monitor wells.	1, 2, 3, 4
GW-03	SB-13 will be converted into a temporary monitoring well.	Assessing the groundwater from the monitor wells.	1, 2, 3, 4
GW-04	MW-1	Field duplicate of GW-01	1, 2, 3, 4
<i>QC Blank Samples</i>			
TB-1	Trip Blank		1
FB-1	Field Blank		1

* Methods listed in Section 4.1.1 of this FSP.

4.1.1 Sample Analysis

The analyses noted for the samples listed in Table 4.1 are described below.

1. VOCs by EPA SW-846 Method 8260C. Soil results will be reported on a dry weight basis.
2. TPH by TCEQ Method 1005. Soil results will be reported on a dry weight basis.
3. SVOCs by EPA SW-846 Method 8270D. Soil results will be reported on a dry weight basis.
4. Total Metals by EPA SW-846 Method 6020A. Soil results will be reported on a dry weight basis.

4.2 Field Quality Control Samples

Applicable field QC samples listed in Table 10 will be collected in accordance with Superfund SOP No. 6.5 (Quality Control Samples). Superfund SOP No. 6.5 Sections 3.1.3.3.a and 3.1.3.3.b are modified to require complete filling of the sample container, and then complete filling of the duplicate sample container. This procedure is applicable to all media.

Table 10 Frequency of Collection of Field Quality Control Samples

Type of QC Sample	Frequency of Collection
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1 per 20 project samples of each matrix. Collect the MS/MSD at a sample location suspected to be contaminated with low to medium levels of target COCs. Do not use highly contaminated samples for the MS/MSD. (To have usable MS/MSD QC data for the project, the sample designated for the MS/MSD analysis should be a project-specific sample.)
Field Blank (FB)	1 per day per 20 samples of each matrix when analyzing for VOCs or other suspected airborne target COCs. Collect the field blank at a sample location before the sample is collected.
Equipment Rinsate Blank (ER)	One at the end of each day for each matrix is required when non-dedicated sampling equipment is used.
Trip Blank (TB)	1 for each cooler containing VOC samples. The sample vials will be filled with ASTM Type II reagent grade water before sample containers are transported to the field. If the containers are coming from the laboratory, the trip blanks will be prepared by the laboratory.
Field Duplicates (FD)	1 per day per approximately 10 project samples of each matrix. Collect the field duplicate at a sample location known or suspected to be contaminated with target COCs, immediately after the sample is collected.
Temperature Blank	1 per cooler.

4.3 Sampling Methods and Sample Handling

4.3.1 Field Sampling Procedures

All samples will be collected in accordance with the QAPP, this FSP and the Superfund SOPs listed in this FSP. All field activities, measurements, and field observations will be recorded in the field logbook. Sections 4.3.1.1.1 and 4.3.1.1.2 describe additional sampling procedures required for this sampling event.

Samples for VOC analysis will be collected first, in accordance with Superfund SOP No. 6.3 (Volatile Organic Compound (VOC) Samples).

The samples are handled as follows:

- Groundwater and surface water samples for VOC analysis not acid preserved must be thermally preserved in the field for transport and storage and analyzed within 7 days of collection.

- Groundwater and surface water samples for VOC analysis acid preserved must be thermally preserved in the field for transport and storage and analyzed within 14 days of collection.

After the VOC samples are collected, the metal samples will be collected, then the samples for TPH and SVOCs will be collected. Section 4.3.3 in this FSP describes the special custody procedures for VOC sample vials.

The GPS location information will be collected and recorded for all sampled points during the sample event as specified in Section 5.2 of this FSP.

4.3.1.1 *Sample Collection*

The Contractor will be accompanied by TCEQ staff during the entire sampling event as budget and schedules allow. Field sampling personnel will wear non-lubricated nitrile disposable gloves, or other suitable disposable gloves, during the handling of all sampling equipment and during sampling. The gloves will be changed between each sample location. Prior to sampling activities, sampling equipment shall be handled pursuant to Superfund SOP 1.5 (Decontamination).

4.3.1.1.1 Soil Samples

The sample locations and depth are determined by the TCEQ PM based on site characteristics and potential exposure pathways. A surface inspection of the subject area will be made to locate pertinent features (e.g., rock outcrops, drainage patterns, surface runoff, and erosion areas) and to evaluate the relationship among these features and potential sources of COCs. The locations of sediment deposition areas are good indicators of surface runoff direction.

Soil borings will be advanced using the procedures in Superfund SOP No. 10.4 (Soil Sampling Using Direct Push). For soil samples collected using direct push, a dedicated acetate sleeve will be used. If dedicated equipment is not used, then equipment rinsate samples shall be collected as specified in Table 10 of this FSP. If refusal is encountered using direct push, the soil borings will be drilled using Superfund SOP No. 5.1 (Hollow Stem Borehole Advancement) and soil samples will be collected in accordance with Superfund SOP No. 10.2 (Soil Sampling Using a Split Barrel Sampler).

All soil sampling activities will be recorded in the logbook.

4.3.1.1.2 Groundwater Samples

The sampling objective is to obtain a representative sample of the groundwater-bearing zone of interest without mixing the sample with stagnant (standing) water in the well casing.

4.3.1.1.2.1 *Groundwater Monitoring Well Installation*

Three temporary monitoring well(s) will be installed. They will be installed from the following soil borings: SB-03 will be converted to GW-01, SB-11 will be converted to GW-02, and SB-13 will be converted to GW-03. The wells will be installed as described in Section 4.3.1.1.1 and completed in accordance with Superfund SOP 5.5 (Monitoring Well Installation and Completion). The monitoring well(s) will be developed prior to groundwater monitoring well sampling in accordance with Superfund SOP 5.6 (Monitoring Well Development and Abandonment). If auger refusal is encountered during monitor well installation, the temporary monitoring well will be installed and completed in the area suspected of having the next highest concentration of metal contaminants.

4.3.1.1.2.2 *Groundwater Samples from a Monitoring Well*

All wells will be purged and sampled according to following SOPs:

- Superfund SOP No. 7.1 (Water Level/Sample Measurement)
- Superfund SOP No. 7.4 (Micro Purging a Monitor Well)
- Superfund SOP No. 7.8 (Groundwater Sampling Using a Low-flow Technique)

An unfiltered sample will be collected from each well and analyzed by the laboratory.

A minimum of three well volumes, including casing volume, shall be pumped or bailed from each monitoring well. Purging is considered complete when three (3) consecutive readings are consistent within 10% RPD for conductivity, $\pm 0.5^{\circ}\text{C}$ for temperature, and within ± 0.5 pH units. The measurements will be collected in accordance with Superfund SOP No. 7.5 (Measurement of Field Parameters). When purging is complete, representative samples will be collected.

For wells pumped or bailed to dryness, the well shall be evacuated and allowed to recover to 90 percent of the original water volume before sample collection. In the event the well has not recovered to 90 percent after 24 hours, the volume recovered will be recorded into the field logbook, and a sample shall be drawn from the well.

4.3.1.1.2.3 *Groundwater Monitoring Well Abandonment*

After monitor well sampling is complete, the well(s) will be plugged and abandoned in accordance with Superfund SOP 5.6 (Monitoring Well Development and Abandonment).

4.3.2 Sample Containers, Sample Preservation, and Holding Time

Sample containers, sample preservation requirements, sample volumes, and holding times are specified in Table B.2.2-1 of the QAPP.

4.3.3 Custody Procedures

Sample handling and custody will be conducted in accordance with Superfund SOP No. 6.4 (Sample Handling and Control). When the sample is introduced into the sample container, the lid or cap shall be tightened onto the container, and a custody seal shall be immediately wrapped around the lid or cap of the sampling container with the following exception:

- VOA sample vials from the same groundwater or surface water sample location will be filled, capped tightly, wrapped in protective wrapping to avoid breakage, and bagged together in a recloseable storage bag, e.g., a disposable plastic bag with a zipper-type closure. The bag will then be closed and a custody seal placed across the closure.

Custody seals will be affixed to every sample jar or container and to every sample shipping cooler except as noted above. The custody seals shall not be broken until received by the laboratory. Custody documentation will be maintained using a custody form that lists each sample and the individual(s) performing the sample collection, shipment, and receipt. A sample is considered in custody if the samples are:

- In the actual possession of a member of the sampling team;
- In the view of a member of the sampling team, after being in physical possession;
- Locked so that no one can tamper with the samples, after having been in physical possession, or;
- In a secured area restricted to authorized personnel.

The field sampling team will use the custody records to document the collection, shipping, and delivery of the samples to the laboratory. The individual who has custody of the sample(s) in their possession will sign the custody form relinquishing custody to the laboratory. The laboratory will immediately contact the Contractor PM if the custody record is not complete for samples received by the laboratory. The laboratory will keep the original custody record in the project files at the laboratory and send a copy of the completed record in the data packages issued to the Contractor.

The custody record will include:

- The unique identification number of each sample;
- The time and date of collection of each sample;
- The number and type of containers of each sample;
- The matrix of each sample;
- The methods of preservation of each sample;
- The analytical methods to be used by the laboratory for each sample;
- The sample(s) designated for the MS/MSD analyses;
- A note identifying samples suspected of containing high concentrations of chemicals;
- If a courier or common carrier is used to transport the sample cooler to the laboratory, the custody record will include the air bill number, the time and date the cooler is sealed, and the signature of the field personnel relinquishing custody to the courier or common carrier;
- The time and date the laboratory accepts custody of the samples and the signature of the laboratory personnel accepting that custody; and
- The temperature of the temperature blank measured by the laboratory upon receipt.

4.3.4 Sample Identification and Documentation of Sampling Activities

Information regarding sample collection will be entered into the field logbook pursuant to Superfund SOP No. 6.1 (Documentation and Reporting). The following information will be recorded in the TCEQ field logbook:

- Date and time of sample collection;
- Environmental matrix and sample type (e.g., soil composite or groundwater grab);
- Sample collection method;
- Sample preservation;
- Name of the person who collected the sample;
- Sample identification number and depth measured from surface of the environmental medium sampled;
- Sample(s) designated for the MS/MSD analyses;
- Field measurements made on the sample, e.g., photoionization readings using a PID;

- When low-flow technology used, the flow rate, e.g., mL/min, as the sample was collected;
- GPS file number;
- Photograph number;
- Date and time of photograph with a description of the purpose of the photograph, e.g. “This photo documents the sample collected at location X of material released to soil from the corroded and leaking drums in the drum storage area observed and documented in photos 2 & 3.”;
- Name of the person who took the photograph and direction the person was facing when the photograph was taken;
- Relevant observations such as soil color, obvious staining, and weather conditions; and
- Deviations from the QAPP, FSP, or SOPs, with the justification or rationale for each deviation documented.

Samples will be adequately marked for identification from the time of collection and packaging through shipping and storage. The sample identification scheme will include:

- Field sample ID;
- Project name and number;
- Sampling date and time;
- Name of the sample collector;
- Method of sample preservation; and
- Laboratory analyses required.

Sample identification will be as follows:

- **Groundwater Samples:** Groundwater samples will be identified using the prefix “GW” followed by a sequential number;
- **Soil Samples:** Surface and subsurface soil samples will be identified using the prefix “SB” followed by a sequential number;
- **Field Duplicate Samples:** For quality assurance purposes, the identification of field duplicate samples will not include any information that may reveal to the laboratory the identity of the primary samples. Field duplicate samples will have a sample number randomly selected by the contractor. The primary samples and associated field duplicate samples will be identified in the contractor’s field notes. The field duplicate sample collection time will be a random increment of time after the collection time of the primary sample. For example, sample GW-76 that has a 14:30 collection time on the chain of custody form is the field duplicate of sample GW-15 that has a collection time of 14:05 on the chain of custody form.

Information regarding the actual collection time and the ID of the primary sample and the field duplicate sample will be recorded in the field logbook;

- **Field Blanks:** Field Blanks will be identified using the prefix “FB” followed by a sequential number;
- **Trip Blanks:** Trip Blanks will be identified using the prefix “TB” followed by a sequential number;
- **Equipment Rinsate Blanks:** Equipment rinsate blanks will be identified using the prefix “ER” followed by a sequential number.

At each sampling location, the collection of the sample will be documented by photographing the sample collection point and, if requested by the TCEQ, by recording the location with certified GPS equipment operated by GPS certified TCEQ staff or contractor personnel. If certified GPS equipment is not available, the sample locations will be identified and the method of identification and site sketch will be included in the field logbook.

5.0 Additional Field Activities

5.1 Property Access

Access agreements between landowners and TCEQ will be obtained prior to initiation of sample collection activities. Form TCEQ-10452 will be used to obtain written access agreements between landowners and TCEQ. In the event the TCEQ is unable to secure a written access agreement from a property owner, verbal agreement of granted access will be documented in the project field notes. If the property is abandoned or the owner cannot be reached, TCEQ Legal Division will determine the appropriate course of action to document access. Copies of the access agreements will be placed in the project file.

5.2 GPS Information

The contractor will record the GPS location of the site, and sampling locations and other pertinent site features as requested by the TCEQ. The contractor will submit all GPS information to the TCEQ as specified in the WO. The GPS data shall be collected pursuant to Superfund SOP No. 17.1 (GPS Data Collection and Submission).

5.3 Equipment Decontamination

Non-dedicated sampling equipment will be decontaminated prior to use and between each sampling location. A decontamination event will be performed at the end of every day and an equipment rinsate sample collected as specified in Table 10. The TCEQ PM may modify the decontamination frequency if necessary. Decontamination of field

equipment will be performed in accordance with Superfund SOP No. 1.5 (Decontamination).

5.4 Investigation Derived Waste

All investigation derived waste (IDW) will be handled in accordance with Superfund SOP No. 1.4 (Investigation-Derived Waste). The contractor will be responsible for collection, containerization, and disposal of all IDW.

Purge waters from wells will be managed according to guidance provided in Superfund SOP No. 1.4 (Investigation-Derived Waste) and "Management of Investigation-Derived Wastes During Site Inspections," EPA/540/G-91/009, May 1991. The preference is to leave both RCRA hazardous and non-hazardous IDW on-site whenever it complies with regulations and does not pose any immediate threat to human health and the environment.

5.5 Site Restoration

The work site and sampling locations will be restored to their original condition in accordance with Superfund SOP No. 1.3 (Site Restoration). Efforts will be made to minimize impacts to work sites and sampling locations, particularly residential properties and those properties in or near sensitive environments.

5.6 Health and Safety

The contractor will develop a site-specific Health and Safety Plan (HASP) to meet the project objectives. During all sampling activities, all field personnel will adhere to the HASP to ensure that all sample collection and decontamination are done in a safe manner. The purpose of this HASP is to assign responsibilities, establish personnel protection standards, specify safe operating procedures, and provide for contingencies that may arise while conducting this investigation. TCEQ personnel will adhere to the HASP while on site.

Prior to commencement of field activities, the contractor's designated H&SO will conduct a safety briefing to inform all personnel of the possible chemical and physical hazards. All personnel will be required to read and sign the HASP, and it will be readily available in the field at all times. The H&SO will conduct a daily safety meeting prior to initiating fieldwork each day to advise workers of ongoing and new health and safety concerns. During the daily safety meeting, the H&SO will identify all potential health and safety risks present at the Site. The H&SO will record the subjects covered during each daily safety briefing, as well as personnel in attendance. These records will become part of the project files. The H&SO will verify all field personnel have completed "OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120)"

training before beginning fieldwork and will verify at least one on-site worker has training in first aid and CPR.

While on-site during field activities, no personnel will eat, drink, or smoke, and all personnel will minimize hand to mouth contact.

5.7 Deviations, Modifications, and/or Departures from the FSP or QAPP

Each deviation, modification, and/or departure from this approved FSP or QAPP needs to be approved by the TCEQ PM and/or TCEQ Project QA Specialist and will be recorded, with a discussion of the rationale for each deviation, in the field logbook.

6.0 Exceptions, Additions, and Changes to the TCEQ Superfund Program QAPP

Proposed exception to QAPP Element D.2.1.3 (Process for Data Validation): The TCEQ Brownfields Program requests an exception to QAPP Element D.2.1.3 for Dallas West Church of Christ sampling event. The data generated during and from this sampling event will be reviewed per QAPP Elements D.2.1.1 and D.2.1.2 but will not be validated as specified in QAPP Element D.2.1.3.

Proposed exception to QAPP Element D.2.3.1 (Data Usability Summary (DUS)): The TCEQ Brownfields Program requests an exception to QAPP Element D.2.3.1 for Dallas West Church of Christ sampling event. A data usability summary report will not be prepared for this sampling event, as the TCEQ PM will instead review the data review memorandum prepared by the contractor to evaluate the usability of the project data.

6.1 Project-Specific Laboratory Changes to Group B (Data Generation and Acquisition) and Group D (Data Validation and Usability)

Accutest Laboratories Gulf Coast, Inc. laboratory has a formal QA program in place that is consistent with the The NELAC Institute (now TNI formerly NELAC) standards. The laboratory has reviewed the QAPP and the FSP and changes to the TCEQ Superfund QAPP are discussed below. The changes are listed by element as they occur in the TCEQ Federal Superfund QAPP (Q-TRAK # 14-453).

Element B.2 Sampling Methods

Element B.2.2 Sample Volumes, Container Types and Preservation Requirements

Table B.2.2-1 – Sample Containers, Volumes, Preservation, and Holding Times

- Exception for Container. The preparatory method listed for volatile organic analysis of soils requires use of Encore, or equivalent, samplers for low level volatile analysis.

Element B.3 Sample handling and Custody

For custody seals, if the laboratory preparation method indicates the need for use of laboratory-provided Encore (or similar) samplers for soil VOC sample collection, the samples from the same soil sample location will be filled, capped tightly, wrapped in protective wrapping and bagged together in the laboratory provided storage bag. The bag will then be closed and a custody seal placed across the closure.

Element B.3.2 Laboratory Sample Handling and Custody

- The laboratory meets exception for procedures ensuring internal laboratory C-O-C. The analytical laboratory does not utilize internal C-O-C procedures.
- Exception for sample disposal. The laboratory will dispose of samples 30 days after final report submittal.

Element B.4 Analytical Methods**Element B.4.1 Screening Methods****Table B4.1-1 SW846 - Percent Moisture**

- The laboratory references analytical method ASTM D2216-90 rather than SW-846 (Section 7.2 of SW3550).

Element B.4.1.3 EPA Method SW1030-Ignitability of Solids

- Laboratory references EPA SW-846 Section 7.1.2.

Element B.5.1 Definitive Analytical Methods

This element states that if lab limits are more stringent than those in the tables, the laboratory control limits shall be used. Some limits are wider and some are tighter. See exception below for Table B.5.1.9-2.

Element B.5.1.9 Method 8260C – Volatile Organics

- Exception on list of MQLs for analytes (Table B.5.1.9-1): Analytical laboratory MQLs are different for several COCs. Current laboratory MQLs are presented in Tables 1 and 5 of this FSP.
- Exception for QC Acceptance Criteria (Table B.5.1.9-2): The analytical laboratory uses laboratory derived control limits.

Element B.5.1.16 Method 6020A – Trace Elements (Metals) by Inductively Coupled Plasma Mass Spectroscopy for Water and Soil

- Exception on list of MQLs for analytes (Table B.5.1.16-1): Analytical laboratory MQLs are different for several COCs. Current laboratory MQLs are presented in Tables 4 and 8 of this FSP.
- Exception for QC Acceptance Criteria (Table B.5.1.16-2): The analytical laboratory uses precision criteria of $\leq 20\%$ RPD for both water and soil matrices.
- Exceptions to Table B.5.1.16-3:
The laboratory uses more than one standard to perform the initial calibration and uses a coefficient of determination (r^2) ≥ 0.990 .
The analytical laboratory performs a post digestion spike addition only if the serial dilution fails to meet the laboratory criteria of 75-125%.

Element B.5.3.2 Laboratory Quality Control Samples and Parameters

Element B.3.2.1 Laboratory Control Sample

- Exception of failing LCS to reextract and reanalyze all samples associated with the given LCS. If LCS is biased high and the associated samples do not detect target compounds, the data are flagged and noted in an Exception Report on the Laboratory Review Checklist.

Element B.5.3.2.7 Method Detection Limit, Method Quantitation Limit, and Sample Detection Limit

- Laboratory MQLs are presented in Section 3.1 of this FSP.

CHANGES TO GROUP D (DATA VALIDATION AND USABILITY)

Element D.2 Verification and Validation Methods

Element D.2.1 Process for Data Verification and Validation

- Exception of the Laboratory QA section performs package and electronic data format deliverables: The analytical laboratory project manager or designee reviews the completed data packages, performs a reasonableness review on the completed data packages, ensures all deliverables are present, and performs a 5% review of the electronic data deliverable.

Appendix A: Superfund Standard Operating Procedures



STANDARD OPERATING PROCEDURE NO. 1.2 PREPARATION AND CONTROL

SOP#: 1.2
DATE: 4/25/2001
REVISION #: 0
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1.0 METHOD SUMMARY

This standard operating procedure (SOP) provides guidance for site preparation and control. It is intended to assist field personnel in preparing the site before conducting any work activities.

2.0 EQUIPMENT/APPARATUS/REAGENTS

2.1 Equipment List

- Appropriate personal protective equipment (PPE)
- Caution tape, orange cones and/or other visible means of delineating boundaries
- Heavy gauge plastic sheeting
- Collection systems for decontamination areas (e.g., sump pump)
- 55-gallon drums or other appropriate containers
- Sheets of plywood
- Hay bales
- 2 x 4 lumber
- Landscape timbers
- Tables or sawhorse benches
- Site Plan

3.0 PROCEDURES

1. Don appropriate PPE.
2. Identify and mark utility locations in accordance with SOP 2.4
3. Designate and mark the decontamination zone with caution tape, orange cones and/or other visible means. To control access of personnel and equipment to possible contaminants, the site will be divided into work zones. There is only one entrance and exit to the zones. Three categories of zones and one command post are utilized. For all operations except Level D, work zones will be designated as follows:
 - a. Support Zone or Clean Zone -- Along with the command post, this is the outermost boundary of the site. Contamination of personnel and equipment in this area is unlikely.
 - b. Contamination Reduction Zone -- This area serves as a corridor between the exclusion zone and the support zone and is the area where decontamination activities occur. All personnel and equipment passing through this corridor from the exclusion zone to the support zone must undergo appropriate decontamination.
 - c. Exclusion Zone -- This is the area where actual operations are being conducted. Access to this area is limited to personnel and equipment being utilized at that particular time for the specific operation in progress. The risk of contamination in this area is high.
4. Create a central decontamination area for drilling rigs and other large equipment (see SOP 1.5). The decontamination area should be large enough to allow storage of cleaned equipment and materials prior to use, as well as drums of decontamination waste. The decontamination area shall be lined with heavy gauge plastic sheeting, and designed with a collection system to capture decontamination waters. Solid wastes shall be accumulated in 55-gallon drums or other appropriate containers and stored in a designated investigative derived waste (IDW) storage area (see SOP 1.4).
 - a. A large equipment decontamination pad can be constructed by placing sheets of plywood on the ground and covering them with plastic sheeting. Walls for controlling over spray can be



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- created from hay bales or by constructing 2 x 4 frames covered with plastic sheeting. Landscape timbers can be used to create berms around the floor of the decontamination pad. A sump pump should be used to collect decontamination water and transfer the water to 55-gallon drums.
- b. A small equipment decontamination line can be created by placing plastic sheeting on the ground and using tables or sawhorse benches to hold wash basins.
 - c. Decontamination lines are site specific since they are dependent upon the types of contamination and the type of work activity onsite. It is usually a location in a shaded area in which the wind can help to cool personnel.
5. Identify the locations of utilities, the field office/laboratory, IDW storage areas, exclusion zone, contamination reduction zone (including decontamination facilities), and the clean zone on a site plan.

4.0 CAUTIONS AND INTERFERENCES

This section is not applicable to this SOP.



STANDARD OPERATING PROCEDURE NO. 1.3 SITE RESTORATION

SOP#: 1.3
DATE: 4/25/2001
REVISION #: 0
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1.0 METHOD SUMMARY

This standard operation procedure (SOP) describes the steps necessary for site restoration. Upon completion of field activities, the site should be repaired to its original condition when possible. All drums or waste containers should be staged in a designated staging area and all other waste should be removed. All borings should be backfilled.

2.0 EQUIPMENT/APPARATUS/REAGENTS

Varies depending on which of the following tasks are completed.

3.0 PROCEDURES

1. Minimize impacts to work sites and sampling locations, particularly those in or near sensitive environments, such as wetlands with the use of soil erosion fences or by diverting streams/brooks during work operations.
2. Fill boreholes and pits, re-vegetate or erect erosion fences as necessary, re-establish streams, brooks, etc, as applicable.
3. Remove all sampling, decontamination equipment, and other items introduced to the site upon completion of work.
4. Remove all drums, trash, and other waste upon completion of work at the site.
5. Transport decontamination and/or purge water and soil cuttings to the designated locations.

4.0 CAUTIONS AND INTERFERENCES

This section is not applicable to this SOP.



STANDARD OPERATING PROCEDURE NO. 1.4 INVESTIGATION-DERIVED WASTE

SOP#: 1.4
DATE: 8/28/2013
REVISION #: 1
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1.0 METHOD SUMMARY

This standard operating procedure (SOP) describes procedures for managing investigation-derived waste (IDW) generated during field activities. IDW should be classified and disposed of in accordance with applicable laws and regulations. **It is the goal of the Superfund Program to properly dispose of all IDW in the fiscal year in which it was generated.** IDW should be properly disposed based on waste classification results. IDW may include, but is not limited to:

- **Environmental media IDW** such as soil cuttings from drilling or hand augering, ground water obtained through well development or well purging, and excess sample material;
- **Personnel protective equipment** (PPE) such as disposable coveralls, gloves, booties, and respirator canisters;
- **Disposable equipment** such as plastic tarps and equipment covers, aluminum foil, PVC pipe, disposable bailers, rope, twine, plastic tubing, broken or unused sample containers, and tape;
- **Trash** such as boxes, packing and shipping materials, and paper;
- **Drilling mud** and **drilling water**; and
- **Purge and Decontamination waters.**

The IDW will be segregated at the Site according to matrix (solid or liquid) and how it was derived (drill cuttings, drilling fluid, decontamination fluids, or purged groundwater). Each container will be properly labeled with site identification, sampling point, matrix, target chemicals of concern, and other pertinent information for handling. Although most of these materials are non-hazardous, occasionally IDW which meets the definition of hazardous waste may be generated. To the extent possible, non-hazardous waste should be segregated from hazardous waste.

2.0 EQUIPMENT/APPARATUS/REAGENTS

2.1 Equipment List

- U.S. Department of Transportation (DOT)-approved containers (e.g., 55-gallon drums, roll-off bins)
- Wrenches for securing drum lids
- Labels and/or paint or pens capable of withstanding outdoor environments for a number of years
- Lumber (for staging area construction)
- Plastic sheeting (for staging area construction)
- Plywood (for staging area construction)
- 5-gallon buckets
- Manifests
- Container log

3.0 PROCEDURES

Segregate the IDW according to matrix (e.g., solid, liquid, sludge), origin, and likely disposal classification (non-hazardous versus hazardous). Classify IDW based on waste classification results.



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If practical, reduce the volume of IDW by compaction. Regularly collect IDW, litter, and garbage to maintain the cleanliness and orderliness of the Site. All IDW should be properly containerized, labeled, staged, and disposed of.

3.1 Non-Hazardous IDW

GENERAL PROCEDURES

The following general procedures apply to non-hazardous IDW that must be containerized, sampled, and/or must remain on-site for a period of time.

1. Keep non-hazardous IDW segregated from IDW that may meet the definition of hazardous waste.
 2. Keep obviously-contaminated IDW (e.g., oily soil cuttings) segregated from apparently non-contaminated IDW.
 3. Place IDW in appropriate containers (e.g., U.S. DOT 55-gallon drums, roll-off bins, trash bags, etc.)
 4. To the extent practical, containerize IDW from different locations separately to facilitate proper classification and disposal. Drill cuttings from different boreholes can be put in the same drums provided they originate from similar areas of the site (e.g., up-gradient, background borings, etc.).
 5. Transport containers to the staging area in a manner to prevent spillage or evaporative loss.
 6. Store containers in an appropriate staging area.
 7. Label each container with site identification, date of accumulation, description and source of the materials, contact information, and other pertinent information.
 8. Record the sample numbers which will be used to classify each container in the field logbook.
 9. Collect classification samples (if appropriate) from the IDW.
 10. Analyze samples for appropriate Target Chemicals of Concern (Target COCs).
 11. Review classification sample results.
 12. Classify the IDW for disposal.
 13. Prepare transport documentation as needed.
 14. Transport IDW to appropriate disposal facility.
-



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15. If the IDW was generated at an active facility, consider obtaining permission from the operator of the facility to place non-hazardous IDW in facility dumpsters, if available.
16. On larger projects, waste hauling services may be obtained and a dumpster located at the site.
17. Include the completed log of IDW information and labeling and a rough sketch of the IDW locations with the identifiers of each container in the field logbook.
18. Maintain a log (Appendix A) of all containers, stating their identification number and contents.
19. Document disposal of IDW in a report or email to the TCEQ Project Manager (PM) (include waste manifests).

UN-CONTAMINATED ENVIRONMENTAL MEDIA IDW

If acceptable to the TCEQ PM, it may be possible to return uncontaminated environmental media to the site based on the analytical results of samples collected from associated environmental media. For example, it may be acceptable to characterize drill cuttings based on the borehole sample results from which the cuttings originated; or well purge-water may be characterized based on the groundwater sample results from the well from which the purge-water originated. For the purposes of this SOP, “uncontaminated” environmental media are soil or water which do not contain Target COCs at concentrations in excess of the TRRP Assessment Level. The following procedures should be used for uncontaminated environmental media as site conditions allow:

1. Containerize and store the environmental media IDW;
2. Associate samples with environmental media IDW;
3. In the field logbook, record associated environmental samples for each container;
4. Collect classification samples from representative containers;
5. Classify the IDW based on 1) analyses of associated environmental samples or 2) samples from environmental media IDW; and
6. After reviewing associated sample results and obtaining TCEQ PM Concurrence, deposit uncontaminated environmental media IDW at the site.

Soil IDW should be properly containerized in U.S. Department of Transportation (DOT)-approved containers (55-gallon drums or roll-off bins), labeled, and staged on-site pending.



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TRASH, DISPOSABLE EQUIPMENT, AND PERSONNEL PROTECTIVE EQUIPMENT (PPE)

Non-investigative waste, such as litter and household garbage, should be collected on an as-needed basis to maintain the Site in a clean and orderly manner. This waste will be containerized and transported to the designated sanitary landfill or collection bin. The following procedures should be followed for disposal of trash, equipment, and PPE.

1. Non-hazardous IDW, such as litter, garbage, and non-contaminated PPE, should be collected, stored in appropriate containers, and properly disposed of.
2. Obviously uncontaminated IDW such as trash may be disposed of in accordance with applicable laws.
3. **With the owner's permission, trash may be disposed** of in available dumpsters, at appropriate landfills, or other public disposal locations.
4. Used PPE should be properly decontaminated, placed in plastic trash bags, and disposed of in accordance with applicable laws.

DRILLING MUD AND DRILLING WATER

The following procedures should be followed for disposal of drilling mud and drilling water.

1. Dispose of drill cuttings, purge or development water, and drilling mud in a permitted landfill or sanitary sewer.
2. Alternatively, obtain permission to place IDW in active facility treatment systems.

PURGE AND DECONTAMINATION WATERS

Purge and decontamination water will be properly containerized, labeled, and stored on site in 55 gallon drums. The following procedures should be followed for disposal of decontamination waters.

1. Collect waste classification samples from decontamination waters.
 2. Classify IDW based on the analytical results.
 3. With the concurrence of the TCEQ PM, pour uncontaminated decontamination water out on the site
 4. Properly dispose of decontamination waters off-site.
-



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3.2 HAZARDOUS IDW

A disposal subcontractor will dispose of any hazardous IDW as specified in applicable regulations.

1. To the extent possible, avoid generating IDW that may meet the definition of hazardous waste.
2. Keep non-hazardous IDW segregated from IDW that may meet the definition of hazardous waste.
3. Properly containerize and label IDW that is suspected to meet the definition of hazardous waste.
4. Store these materials in appropriate containers at a segregated staging area with a secondary containment structure.
5. Perform waste classification analyses requested by the potential disposal facility.
6. Review sample results to determine waste classification.
7. Manifest and transport hazardous waste to a permitted treatment or disposal facility in accordance with waste classification and applicable laws.
8. If required, file an Annual Waste Summary with the TCEQ Office of Waste by the applicable deadline.

4.0 CAUTIONS AND INTERFERENCES

Further guidance on IDW requirements for CERCLA sites may be found at:

http://www.epa.gov/superfund/policy/remedy/pdfs/RCRA_Biennial_Report_Requirements_for_CERCLA.pdf



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APPENDIX A

DRUMMED MATERIAL WORKSHEET

Project Name	Project Number
Site Address	Project Manager

Drum No.	Boring No.	Date	Contents	Sample ID	Lab Results	Disposition



STANDARD OPERATING PROCEDURE NO. 1.5 DECONTAMINATION

SOP#: 1.5
DATE: 8/28/2013
REVISION #: 1
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1.0 METHOD SUMMARY

This standard operating procedure (SOP) provides a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment used during hazardous waste operations. This SOP does not address detailed personnel decontamination; however, all disposable Personal Protective Equipment (PPE) will be decontaminated such that it can be disposed of as Class 3 waste. Non-dedicated sampling equipment and tools will be decontaminated prior to use and between sample locations. Dedicated sampling equipment will be decontaminated prior to first use, unless certified free of contaminants by the manufacturer. The TCEQ Project Manager (PM) may modify the decontamination frequency, as appropriate.

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

2.0 EQUIPMENT/APPARATUS/REAGENTS

- non-phosphate detergent
- tap water
- distilled or deionized water
- long and short handled brushes
- bottle brushes
- drop cloth/plastic sheeting
- paper towels
- plastic or galvanized tubs or buckets
- pressurized sprayers
- aluminum foil
- re-sealable bags
- trash bags
- appropriate personal protective equipment (PPE)
- face shield (for hard hat)
- high pressure washer (if necessary)
- fuel for high pressure washer
- 55-gallon drums
- plywood
- sump pump
- landscape timbers, 4 x 4's, or 2 x 4's

3.0 PROCEDURES

3.1 Decontamination

Decontamination of drilling equipment, well construction materials, sampling equipment, tools, etc. shall be described in the project work plan or field sampling plan. All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. This includes casing, drill bits, auger flights, the portions of drill rigs that stand above boreholes, sampling devices, and instruments, such as slugs and sounders. In addition, the contractor shall take care to prevent the sample from coming into contact with potentially contaminating substances, such as tape, oil, engine exhaust, corroded surfaces, and dirt.



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The following procedures shall be used to decontaminate large pieces of equipment, such as casings, auger flights, pipe and rods, and those portions of the drill rig that may stand directly over a boring or well location or that come into contact with casing, auger flights, pipe, or rods:

1. Prepare the decontamination zone in accordance with SOP 1.2.
2. Don appropriate PPE.
3. Deposit the contaminated equipment on the plastic drop cloth/sheet or in a container inside the contaminant reduction zone (CRZ).
4. Place large pieces of equipment (e.g., auger flights) on sawhorses.
5. Use a high-pressure washer and a low-phosphate soap (e.g., Alconox) to remove encrusted material from grossly contaminated equipment. If necessary, use a brush to scrub the equipment until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., have been removed.
6. Rinse all equipment with potable water.
7. Store the equipment on sawhorses or wrapped in clean plastic sheeting.
8. Decontamination water should be collected and transferred to a 55-gallon drum at the end of the day or whenever significant quantities of water have accumulated. Drums of investigative derived waste (IDW) should be managed in accordance with SOP 1.4.

The following procedures shall be used to decontaminate small pieces of sampling equipment such as split spoons, bailers, trowels/spoons and bowls:

1. Prepare the decontamination zone in accordance with SOP 1.2.
2. Don appropriate PPE.
3. Scrub the equipment with a solution of potable water and low-phosphate soap (e.g., Alconox).
4. If organic constituents are contaminants of concern, rinse the equipment with a pesticide-grade solvent, typically acetone. If acetone is a constituent of concern, substitute methanol as the rinse agent.
5. Rinse the equipment with copious quantities of distilled or deionized water.
6. Allow the equipment to air dry on a clean surface or rack elevated at least two feet above ground.

Wrap the sampling device in aluminum foil or place in sealable plastic bags prior to reuse.

The following procedures shall be used to decontaminate equipment used in the sampling of media potentially contaminated with metals.

- rinse all equipment with potable water;
- clean equipment with a brush in a solution of laboratory grade detergent (Liquinox, Alconox, or equivalent);
- rinse with potable water;
- rinse with 10% nitric acid solution (trace metals grade);
- rinse with distilled or deionized water;



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- rinse with reagent grade isopropanol if also analyzing for organic compounds;
- rinse with deionized water;
- Allow equipment to completely dry, then collect an equipment rinsate sample using ASTM Type II reagent grade water, seal the rinsate sample container with a custody seal, and place the sample in the shipment cooler;
- Place the equipment on clean plastic sheeting and allow to air dry; and
- If the equipment is not to be used immediately, place small equipment in plastic sealable bag and place a custody-seal across the sealed opening of the bag.

At the completion of the decontamination activities, all fluids and solid waste should be containerized and managed in accordance with SOP 1.4.

If a particular contaminant fraction is not present at the site, the ten (10) step decontamination procedure specified above may be modified for site specificity. For example, the solvent rinse may be eliminated if organics are not of concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

4.0 CAUTIONS AND INTERFERENCES

1. The use of distilled/deionized water commonly available from commercial vendors is typically acceptable for decontamination of sampling equipment.
2. The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.
3. If solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.
4. Damage can be incurred by solvent washing of complex and sophisticated sampling equipment.



STANDARD OPERATING PROCEDURE NO. 2.4 BELOW GROUND UTILITY SURVEY

SOP#: 2.4
DATE: 8/28/13
REVISION #: 1
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1.0 METHOD SUMMARY

The objective of this standard operating procedure (SOP) is to provide guidance for a utility survey.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following equipment is typically used for conducting field utility surveys:

- Metal detector or magnetometer
- Notebook
- Camera
- Tile probe

3.0 PROCEDURE

1. Obtain and review copies of facility drawings to identify utility lines that may be located on the property. A utility locating service may be necessary if numerous lines are located on private property, if onsite utility locations are not well known, or if underground obstructions (drums, tanks, etc.) are suspected.
2. In accordance with the Texas Underground Facility Damage Prevention and Safety Act, contact a state notification center (e.g., “Texas811” or “Lonestar 811”) at least 48 hours and not more than 14 days (excluding Saturday, Sunday, and legal holidays) in advance of proposed excavation activities deeper than 16 inches, to provide notification to underground utility operators to mark subsurface utilities. (A private locating service is not acceptable as the only means of locating utilities). Schedule a utility locating session with participating utility companies, if needed. Individual utility companies may request that the excavation locations be marked in advance of providing clearance or that a representative be present onsite during the excavation. If required, excavation locations should be marked in white, consistent with American Public Works Association color coding standards. It is recommended that responses from individual utilities be tracked and confirmation of a response from each notified utility be verified prior to beginning excavation activities, even if the 48-hour notification window has elapsed.
3. Obtain and review copies of map surveys to identify utility easements.
4. Call municipal utilities to identify locations of underground utility lines.
5. Inspect the site for pipeline marker posts and utility location markings.
6. Screen each sample location with a metal detector or magnetometer to verify that no underground pipes or drums exist.
7. Probe boring locations with a tile probe to verify that no non-metallic obstructions exist.
8. Mark located subsurface utilities and obstructions as to their approximate locations using paint, stakes or other appropriate methods for immediate notice and later survey.
9. Document the steps taken to identify and mark the location of subsurface utilities and obstructions in the field log book. Maintain records of notification center ticket numbers and clearance reports from utility companies.



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4.0 CAUTIONS AND INTERFERENCES

Operators of Class B underground facilities (water, sewer, and slurry lines) may not receive information of the excavation from a notification center and should be contacted directly to verify locations. Utility locating services (e.g., those notified through the notification center) typically do not mark utility lines on private property. The contractor should review all utilities identified at the site boundaries to verify their point of entry onto the site.



STANDARD OPERATING PROCEDURE NO. 3.0 GEOLOGICAL OBSERVATIONS

SOP#: 3.0
DATE: 8/28/2013
REVISION #: 1
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1.0 METHOD SUMMARY

This SOP provides guidance for conducting borehole logging and soil classification to adequately record lithologic information at any given boring location. All drilling activities shall be logged daily in a bound field notebook in accordance with SOP 6.1. Reporting requirements are also discussed.

2.0 EQUIPMENT/APPARATUS/REAGENTS

No specialized equipment is required for performing work in accordance with this SOP. The only materials needed are:

- Logbook
- Tape measure
- Compass (in the absence of a survey)
- Camera and Film
- Munsell soil color charts
- Clipboard
- Boring log forms
- Pens

3.0 PROCEDURES

3.1 Borehole Logging

Unconsolidated samples for lithologic description shall be obtained at each change in lithology or every five (5) foot interval, whichever is less, or as specifically stated in the Work Order. Lithologic descriptions of unconsolidated materials encountered in the boreholes shall generally be described in accordance with American Society for Testing and Materials (ASTM) D-2488-90 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM, 1990). Lithologic descriptions shall use the name of the predominant particle size (e.g., silt, fine sand, etc.). Consolidated materials (igneous, metamorphic, and sedimentary rocks) shall be described as per the standard professional nomenclature (cf. Tenissen, A.C., 1983, Nature of Earth Materials, 2nd Edition, pp. 204-348), with specific attention given to describing fractures, vugs, solution cavities, and their fillings or coatings, and any other characteristics affecting permeability.

A standard boring log form shall be used for recording the logged information. The information on the boring log shall include borehole location; drilling information; sampling information such as lithology, sample intervals, recovery, and blow counts; sample description information; and monitoring equipment. If a monitoring well is installed in the boring, a graphical depiction of the well construction may be included. Additional information to be recorded includes the depth to the water table, caving or sloughing of the borehole, performance of the drill rig, drilling fluid pump rate, changes in drilling rate, depths of laboratory samples, presence of organic materials, disposal method for investigation derived waste, decontamination procedures, and other noteworthy observations or conditions, such as the locations of geologic boundaries.

All samples shall be monitored with an organic vapor monitor (e.g., photo ionization detector (PID), Organic Vapor Analyzer (OVA)). Samples handling procedures shall be mentioned on the logs. Cuttings shall be examined for loss of volatiles and other hazardous characteristics. Abnormal color, odor or organic vapor readings shall be noted.

Borehole abandonment procedures shall be discussed. All abandoned boreholes shall be checked 24 to 48 hours after mud/solid bentonite emplacement to determine whether curing is occurring properly.



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If settling has occurred, a sufficient amount of mud/solid bentonite shall be added to fill the hole to the ground surface. These curing checks shall be recorded in the field log.

3.2 Soil Classification

Identification of the soils shall be accomplished by the United Soil Classification System (USCS). Descriptive information to be recorded in the field shall include: (1) identification of the predominant and secondary particle sizes and range of particles size, (2) percent of gravel, sand, fines or all three, (3) description of grading and sorting of all coarse particles, (4) particle angularity and shape, (5) maximum particle size or dimension and (6) color using Munsell Color System. The approximate particle size descriptions (e.g. course sand). The grain size and name of the deposit shall be accompanied by the predominant mineral content, accessory minerals, color, particle angularity, and any other characteristics.

Plasticity of fines description shall include: (1) (2) moisture (dry, moist or wet), (3) consistency of fine grained soils, (4) structure of consolidated materials, and (5) maximum particle size or dimension.

3.3 Reporting of Geological Observations

All geological observation (borehole logging, stratigraphic information, etc.) will be tabulated, mapped, summarized or otherwise appropriately presented in the report to TCEQ (e.g. boring logs, monitor well completion diagrams, perpendicular cross-sections, fence diagrams, tabulated water level data, potentiometric surfaces, gradient contour maps etc.). Geological observations will be developed from onsite and nearby boring logs and other available references as appropriate. Standard boring log forms will be submitted with the report and will include the following as applicable:

- continuous soil profiling which includes lithologic descriptions using the Unified Soil Classification System (USCS) per ASTM Standard Practice D 2488 (field classification method);
- determination of boundaries between hydrogeologic units;
- continuous field screening of the soil column by headspace techniques, as appropriate, with a properly calibrated instrument appropriate for the requirements of the site [e.g., PID, FID, OVM, OVA and/or CGI (for explosive vapor screening)];
- observations evidencing contamination or other unusual conditions;
- depth of boring and reason for termination;
- location and depth where samples were taken;
- well construction details, as appropriate, (e.g., cements, grouts, filter packs, seals, screen, depths of placement as well as any other pertinent details);
- explanation of any soil boring problems, unusual site conditions, detailed stratigraphic descriptions or any other information necessary to convey how the boring was installed and the nature of the subsurface conditions that were encountered; and
- geotechnical information such as blow counts, color, grain size distributions, and plasticity (if available).

4.0 CAUTIONS AND INTERFERENCES

No cautions or interferences are presented in this SOP.



STANDARD OPERATING PROCEDURE NO. 5.1 HOLLOW STEM BOREHOLE ADVANCEMENT

SOP#: 5.1
DATE: 11/29/2001
REVISION #: 0
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1.0 METHOD SUMMARY

Hollow-stem augers allow for a variety of soil core sampling methods. This method does not require the use of drilling fluids or lubricants and allows for the installation of well screens prior to removal of the auger. Formation waters can be sampled during drilling by using a screened lead auger or advancing a well point ahead of the auger.

Hollow-stem auger methods are commonly used in cohesive soils or in granular soils above the groundwater level. The hollow-stem auger column rotates as it drills into the ground and is designed to push soil up and out of the borehole along the outside of the auger. The hollow-stem augers are designed to be advanced with a center bit or plug to prevent soil from rising through the hollow portion of the auger.

2.0 EQUIPMENT/APPARATUS/REAGENTS

Equipment needed for borehole advancement using hollow stem augers may include:

- Maps/plot plan
- Safety equipment
- Tape measure
- Survey stakes or flags
- Camera and film
- Trowel
- Logbook
- Field data sheets
- Decontamination supplies/equipment
- Spade or shovel
- Drill rig and associated drilling equipment
- Plastic sheeting
- Potable water for mixing
- Drums

3.0 PROCEDURES

The following procedure will be used for borehole advancement using hollow stem augers:

1. Prior to drilling perform a utility survey in accordance with SOP 2.4 in the vicinity of the drilling site can be marked and identified.
2. Prior to mobilization, the drill rig and all associated equipment should be thoroughly decontaminated in accordance with SOP 1.5 (Decontamination).
3. Clear the area of any surface debris (e.g., twigs, rocks, litter).
4. Advance the hollow stem auger at a slow rate during the first five to seven feet of drilling as an extra precaution so that any possible contact with underground utilities will be less damaging.
5. Hollow-stem auger flights are five feet in length, therefore drilling is temporarily halted at five foot intervals so that additional flights can be attached. Auger flights are attached to one another by threaded ends and bolts.
6. Attach the center bit to center rod and place inside the hollow stem auger or if soil samples are not to be taken. Alternatively, a wooden center plug can be placed at the bottom of the auger to stop soil from entering the hollow portion of the auger.
7. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near



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the hole or in an appropriately labeled drum.

8. If sampling or geotechnical evaluation is to take place during drilling, advancement of the hollow-stem auger can be temporarily stopped and the center bit can be removed. A device such as a split barrel sampler or a thin wall sampler can be attached to the center rod and lowered to the bottom of the bore hole (see SOP 10.2 Soil Sampling Using a Split Spoon). Sampling or testing occurs in the undisturbed region of the soil immediately beneath the deepest auger flight.
9. When the bore hole has been advanced to the desired depth, the center rods or wooden plug can be removed, thereby allowing well casing to be installed (see SOP 5.5 Monitor Well Installation/Completion).
10. If the borehole is not to be closed through procedures as outlined in other SOPs, then it shall be abandoned according to applicable State regulations.
11. Excavated material, PPE, and the plastic sheeting should be placed in 30- or 55-gallon drums according to the procedures outlined in SOP 1.4 (IDW).
12. Upon removal of the auger flights and other down-hole drilling equipment, all of the equipment should be decontaminated according to the procedures outlined in SOP 1.5 (Decontamination).

4.0 CAUTIONS AND INTERFERENCES

Drilling rigs and equipment present a variety of safety hazards. A site health and safety plan should be developed prior to any drilling activities, and should be followed during all drilling activities. All personnel conducting drilling activities should be qualified in proper drilling and safety procedures. Before any drilling activity is initiated, the area should be surveyed with the necessary detection equipment to locate, flag, or mark all under ground utilities such as electrical lines, natural gas lines, fuel tanks and lines, water lines, etc.

In addition, overhead obstructions (e.g., process piping, structures, or power lines) should be noted. Before operating the drill rig, a pilot hole should be dug (with hand equipment) to a depth of two to three feet to check for undetected utilities or buried objects. Proceed with caution until a safe depth is reached where utilities normally would not be buried. The following safety requirements should be adhered to while performing drilling activities:

1. All drilling personnel should wear safety hats, safety glasses, ear plugs, and steel toed boots.
2. All personnel directly involved with the drilling rig(s) should know where the kill switch(s) is located in case of emergencies.
3. All personnel should stay clear of the drill rods or augers while in motion, and should not grab or attempt to attach a tool to the drill rods or augers until they have completely stopped rotating.
4. Do not hold drill rods or any part of the safety hammer assembly while taking standard penetration tests or while the hammer is being operated.
5. Do not lean against the drill rig or place hands on or near moving parts at the rear of the rig while it is operating.
6. Keep the drilling area clear of any excess debris, tools, or drilling equipment.
7. Do not climb on the drilling rig while it is being operated or attempt to repair the rig while it is being operated.
8. Do not move or pick up any drilling equipment unless directed by the driller and/or the project leader.



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9. The drill rig should have a first-aid kit and a fire extinguisher located on the rig quickly accessible for emergencies.
10. Work clothes will be form fitting, but comfortable and free of straps, loose ends, strings etc., that might catch on some moving part of the drill rig.
11. Rings or other jewelry should not be worn while working around the drill rig.
12. The drill rig should not be operated within a minimum distance of 20 feet of overhead electrical power lines and/or buried utilities that might cause a safety hazard. In addition, the drill rig should not be operated while there is lightning in the area of the drilling site. If an electrical storm moves in during drilling activities, vacate the area until it is safe to return.
13. As the boring is advanced to greater depths, a considerable delay may occur before the soil cuttings appear at the ground surface, limiting the ability of the driller and the field representative to detect changes in soil conditions.



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1.0 METHOD SUMMARY

The design and installation of permanent monitoring wells involves drilling into various types of geologic formations that exhibit varying subsurface conditions. Designing and installing permanent monitoring wells in these geologic environments may require several different drilling methods and installation procedures.

Double cased wells may be required when there is reason to believe that interconnection of two aquifers by well construction may cause cross contamination, and/or when flowing sands make it impossible to install a monitoring well using conventional methods. An outer casing (sometimes called a surface or pilot casing) should be placed into the borehole and sealed with grout.

Each permanent monitoring well should be designed and installed to function properly throughout the duration of the monitoring program. When designing monitoring wells, the following should be considered:

- short-and long-term objectives;
- purpose(s) of the well(s);
- probable duration of the monitoring program;
- contaminants likely to be monitored;
- migration characteristics of the release;
- types of well construction materials to be used;
- surface and subsurface geologic conditions;
- properties of the aquifer(s) to be monitored;
- well screen placement;
- general site conditions; and
- potential site health and safety hazards.

2.0 EQUIPMENT/APPARATUS/REAGENTS

Equipment needed during well installation activities:

- Maps/plot plan
- Appropriate personal protective equipment (PPE)
- Tape measure
- Logbook
- Bentonite powder/pellets
- Filter pack material
- Portland cement
- Steel protective casing and locking cap
- Threaded end-cap (sump)
- Well casing (e.g., PVC or stainless steel)
- Well screen (e.g., PVC or stainless steel)
- Tremie Apparatus
- Decontamination supplies/equipment
- All required health and safety equipment
- Clipboard



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3.0 PROCEDURES

3.1 Monitoring Well/Piezometer Installation

When selecting the materials for well construction, the prime concern should be to select materials that will not contribute foreign constituents, or remove contaminants of concern from the ground water. All materials selected for monitoring well installation should be evaluated and approved by an experienced geologist.

Well screen and casing materials generally used in monitoring well construction on Superfund sites are listed in order of preference:

- Rigid PVC meeting NSF Standard 14
- Stainless Steel (304 or 316)
- Other (e.g., black iron, carbon steel, galvanized steel, and fiberglass). These materials are not recommended for use in long term monitoring programs at hazardous waste sites, because of their low resistance to chemical attack and potential constituent contribution to the ground water.

The length of well screens in permanent monitoring wells should be long enough to effectively monitor the interval or zone of interest. However, well screens designed for long term monitoring purposes should normally not be less than 5 feet in length. Well screens less than 5 feet long should be used only in temporary monitoring wells where ground water samples are collected for screening purposes. Slot openings for well screens should be selected to retain 90 per cent or more of the filter pack material.

The following procedures should be followed when installing a monitoring well:

1. Advance a bore hole to the required depth using the procedures outline in one of the following SOPs; SOP 5.1 (Hollow Stem Borehole Advancement), SOP 5.2 (Solid Stem Borehole Advancement), SOP 5.3 (Mud Rotary Borehole Advancement), or SOP 5.4 (Air Rotary Borehole Advancement).
2. The diameter of the well to be installed will depend on the intended use for the well and possible engineering considerations and needs. A minimum two-inch annular space is required between the borehole and the casing.
3. All well screen and well casing material should be new and of adequate structural integrity, and should be made of material that will be compatible with the contaminants present (or anticipated). Screen size should be determined based on sieve analysis results. Screen length should be adequate to monitor the zone of interest, and in general should not be less than five feet long nor greater than 20 feet.
4. If required, place a threaded sump on the bottom most section of well screen and lower the section into the open bore hole. The decision for placing sumps on wells will be made on a site specific basis.
5. Thread additional lengths of well screen together, as needed, until the appropriate total well screen length is achieved. Do not use cement or glue.
6. Thread solid well casing (in 10-foot lengths) on to the well screen sections to complete the well to a height approximately two to three feet above ground surface. Do not use cement or glue.
7. Centralizers should be placed on wells greater than 50 feet.
8. Plumb the well string by the use of centralizers and/or a plumb bob and level. Another method of placing the well screen and casings into the borehole and plumbing it at the same time is to suspend the string of well screen and casings in the borehole by means of the wire line on the drill rig. The string of well screen and casings can be placed into the borehole and plumbed in one easy operation. This wire line method is



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especially useful if the borehole is deep and a long string of well screen and casings have to be set and plumbed. Centralizers can be used to plumb a well, but centralizers should be placed so that the placement of the filter pack, bentonite pellet seal, and annular grout will not be hindered. Centralizers placed in the wrong locations can cause bridging during material placement. Monitoring wells less than 50 feet deep generally do not need centralizers. If centralizers are used they should be placed below the well screen and above the bentonite pellet seal.

9. Install a locking well cap onto the well head. The well cap should have a small hole drilled to allow for pressure equalization.
10. Place a minimum of 6-inches of filter pack material under the bottom of the well screen or sump to provide a firm footing and an unrestricted flow under the screened area. Filter pack should extend a minimum of two feet above the top of the well screen, and should be placed by a tremie pipe where possible. If drilling with hollow-stem augers, the augers should be lifted as the sand is tremied into the bore hole.

If it is impracticable to tremie the filter pack, pouring the sand is acceptable in shallow bore holes (less than 50 feet), where the annular space is large enough to prevent bridging. The level of the filter pack materials must be measured at appropriate intervals to ensure no bridging has occurred.

11. Once the filter pack material has been placed, place a seal above the filter pack in the annulus of the bore hole to provide a watertight seal. The seal should be a minimum of two feet thick and should consist of a minimum of 20 percent solids bentonite. This type of bentonite is available in either powder or pellet form.

The preferred method of placing either bentonite pellets or a bentonite powder/water mixture is by tremie pipe. If this method is not practicable (pellets only), pouring the pellets is acceptable in shallow bore holes (less than 50 feet), where the annular space is large enough to prevent bridging. The pellets must be tamped, and measured at appropriate intervals to ensure they have not bridged.

The bentonite seal must be allowed to hydrate for eight hours or the manufacturer's recommended hydration time, whichever is greater. Measure the seal after hydration time to ensure that the required two feet of seal is present.

12. After the bentonite seal has hydrated, grout the remainder of the borehole to prevent surface water infiltration.
13. Prepare the grout mixture for use. The preferred grout to use should be a 30% solids bentonite grout with a minimum density of 10 lb/gal. All grouts should be prepared in accordance with the manufacturers specifications. Cement grouts should be mixed using 6.5 to 7 gallons of water per 94-lb bag of Type 1 Portland cement. The addition of bentonite (5 to 10 percent) to the cement grout is generally used to delay the "setting" time and may not be needed in all applications. The specific mixtures and other types of cement and/or grout proposed should be evaluated by an experienced geologist on a case by case basis. Drilling muds are not acceptable for grouting.
14. Place the grout mixture into the borehole, by the tremie method, from the top of the bentonite seal to within 2-feet of the ground surface or below the frost line, whichever is greater. The tremie tube should have an option of a side discharge port or a bottom discharge port, to minimize damage to the filter pack and/or the bentonite pellet seal, during grout placement.
15. Continue the grouting operation until the grout flowing out of the borehole has achieved a significant density.



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16. Place the steel protective casing over the top of the well using with a spacer to keep the protective casing from resting directly on top of the well casing. Ensure that the lower end of the protective casing extends into the grout seal.
17. The outer protective casing should be installed into the borehole a minimum of 24 hours after the grout has been poured.
18. Allow the grout to cure for a minimum of 24 hours before installing the concrete surface pad or conducting well development activities.
19. Clean and decontaminate all of the equipment used following the procedures outlined in SOP 1.5 (Decontamination).
20. Document the installation of the well screen and riser, height of the filter pack, installation and thickness of the annular seal, types and quantities of grout material used in the field logbook, recording the type of materials used, the lengths of screen and riser sections, the bottom depth of the boring, the screen slot size, and any sumps or caps placed on the bottom of the well.

3.1.1 Surface Completions

1. Outer Protective Casings

The outer protective casings used over 2-inch well casings should be 4 inches square by 5 feet long. Similarly, protective casings used over 4-inch well casings should be 6 inches square and 5 feet long. Round protective casings are also acceptable. All protective casings should have sufficient clearance around the inner well casings, so that the outer protective casings will not come into contact with the inner well casings after installation. The protective casings should have a minimum of two weep holes for drainage. These weep holes should be a minimum 1/4-inch in diameter and drilled into the protective casings just above the top of the concrete surface pads to prevent water from standing inside of the protective casings. Protective casings made of aluminum or other soft metals are normally not acceptable because they are not strong enough to resist tampering. Aluminum protective casing may be used in very corrosive environments such as coastal areas. After the wells have been installed, the outer protective casing should be painted with a highly visible enamel paint. The wells should be permanently marked with the well number, date installed, site name, and elevation on a brass plate to be permanently affixed to the cover or an appropriate place that will not be easily damaged and/or vandalized.

A case-hardened steel lock should be installed on the locking casing cap to provide well security. This lock should be covered by some protective measure (i.e., a plastic covering) to prevent corrosion. Lubricants should not be used on the lock as they may contribute to chemical sample alteration. At each site, all locks on the outer protective casings should be keyed alike. There should be at least 1 to 2 inches of clearance between the top of the in-place inner well casing cap and the bottom of the protective casing locking cap when in the locked position. The protective casing should be anchored into the cement surface seal and extend at least 18 inches above the surface of the ground.

Upright completions are the preferred completion method, but if the monitoring wells are installed in a high traffic area such as a parking lot, in a residential yard, or along the side of a road it may be desirable to finish the wells to the ground surface and install water-tight flush mounted traffic and/or man-hole covers. Flush mounted traffic and man-hole covers are designed to extend from the ground surface down into the concrete plug around the well casing. Although flush mounted covers may vary in design, they should have seals that make the unit water-tight when closed and secured. The flush mounted covers should be installed as far above grade as practical to minimize standing water and promote runoff.



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2. Concrete Surface Pad

A concrete surface pad should be installed around each well at the same time as the outer protective casing is being installed. The concrete used should be a reinforced concrete. The surface pad should be formed around the well casing. Concrete should be placed into the formed pad and into the borehole (on top of the grout) in one operation making a contiguous unit. The size of the concrete surface pad should be 4 feet x 4 feet x 6 inches with #3 Rebar at 18" on center each way (O.C.E.W).

The finished pad should be sloped 1/4 inch at 4', so that drainage will flow away from the protective casing and off of the pad. In addition, a minimum of four inches of the finished pad should be below grade or ground elevation to prevent washing and undermining by soil erosion.

3. Surface Protection-Bumper Guards

If the monitoring wells are located in a high traffic area, a minimum of four bumper guards consisting of steel pipes 6 inches in diameter and a minimum 6-foot length should be installed. These bumper guards should be installed to a minimum depth of 3 feet below the ground surface in a concrete footing and extend a minimum of 3 feet above ground surface. Concrete should also be placed into the steel pipe to provide additional strength. As shown in the figure below. Steel rails and/or other steel materials can be used in place of steel pipe but should be approved by an experienced engineer prior to installation.

3.2 Temporary Piezometers

A temporary piezometer is a small diameter cased borehole placed in a direct push borehole. The size of the borehole usually does not allow for filter pack to be placed in the piezometer annulus. The intent of a temporary borehole is to obtain water level data to determine the proper location of monitoring wells. Temporary piezometers differ from permanent piezometers in the following ways:

1. Casing is generally one-inch in diameter or less.
2. Filter pack is not necessary for temporary piezometers.
3. Screen lengths are generally less than five feet.
4. A smaller pad is used to stabilize the top of the piezometer.

Specifications of temporary piezometers will be approved by the TCEQ on a site specific basis.

3.3 Surface Casing

When determined necessary by the TCEQ PM, surface casing consists of a watertight pipe which is installed in an excavated or drilled hole, temporarily or permanently, to maintain the hole sidewalls against caving, advance the borehole, and in conjunction with cementing and/or bentonite grouting, to confine the ground waters to their respective zones of origin, and to prevent surface contaminant filtration.

The drilled hole shall be of sufficient diameter to allow for a minimum two inch annular space between the borehole and the casing. The borehole shall be advanced by hollow stem auger or other approved method a minimum two feet into the confining zone or other desired depth. The casing shall be assembled and placed into the center of the boring. The casing shall be grouted with cement bentonite grout in such a manner that the desired zone is sealed and no voids remain in the annular space. The cement bentonite grout shall be allowed to cure 24 hours before advancing the boring.

3.4 Well Identification

This provides guidance to use standard nomenclature for numbering or identifying Monitoring Wells in reports and on identification plates, installed on the Monitoring Wells. All the Monitoring Wells shall be surveyed by a licensed surveyor.



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1. Permanent identification marking should be placed on the well or on the brass monument installed in the protective concrete pad.
2. The identification marking should contain Well Number, Depth of the Well, Installation Dated, Site Name, MSL Elevation.
3. A small key of abbreviations shall be added on the bottom of every table and map.
4. The wells shall be identified as follows:

MW- X	Monitor well completed in the uppermost saturated zone/aquifer or shallow aquifer, where the A X@ represents the well number, in consecutive order of installation. At no time will any two wells have the same well number, that is, there will not be a well number MW-3 and RW-3 at the same site.
RW-X	Monitor well used as a recovery well in shallow aquifer.
W- X	Monitor well used as an injection well. This includes both wells used for nutrient injection during bio-remediation activities and for re-injection of treated groundwater.
PW-X	Piezometer.

4.0 CAUTIONS AND INTERFERENCES

When installing doubled cased wells, the surface casing should be allowed to set for 24 hours after installation, before completing the installation of monitoring well.

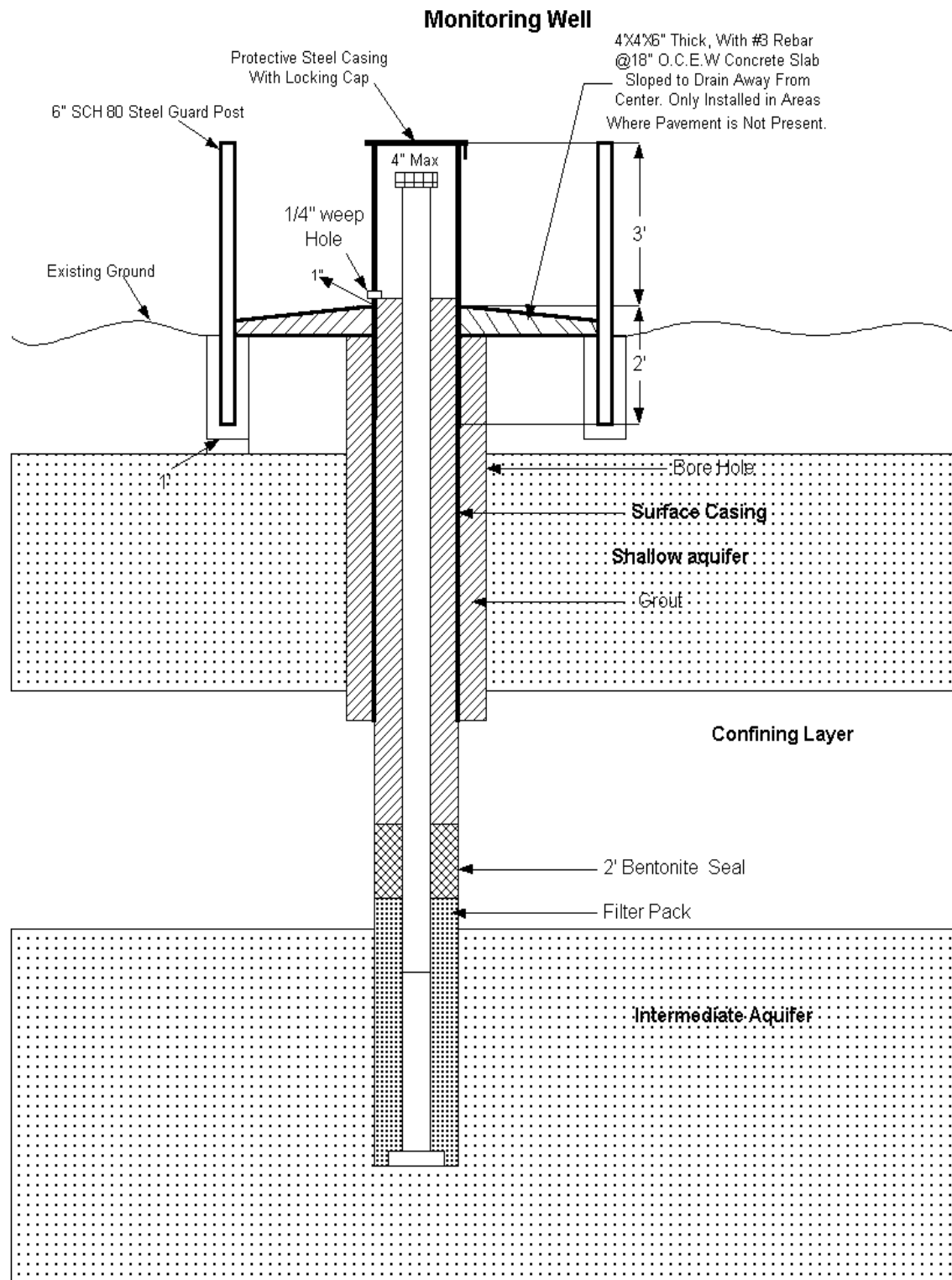
Care should be taken to avoid bridging of filter pack material.

Wells should be allowed to set for 24 hours after installation, before well completions or well development activities are performed.



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STANDARD OPERATING PROCEDURE NO. 5.6 MONITORING WELL DEVELOPMENT/ABANDONMENT

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1.0 METHOD SUMMARY

The purpose of developing new monitoring wells is to remove residual materials remaining in the wells after installation has been completed, and to establish a good hydraulic communication between the formations in the immediate vicinity of each well and the well which may have been disturbed by well construction.

The following development methods are generally used to develop monitoring wells:

- Pumping
- Compressed air (with the appropriate organic filter system)
- Bailing
- Surging
- Backwashing ("rawhiding")
- Jetting

2.0 EQUIPMENT/APPARATUS/REAGENTS

Equipment needed during well development activities:

- Maps/plot plan
- As-built diagrams of monitoring wells
- Logbook
- Field data sheets
- Appropriate personal protective equipment (PPE)
- Water level indicator
- Camera and film
- Bailer or pump
- Nylon rope
- Pump controller (if required)
- Generator, if pump is used
- Air compressor, if bladder pump is used
- Gas for generator/air compressor
- Surge block
- Appropriate pump fittings (e.g., hose clamps, barbed fittings, etc.)
- Discharge tubing for pump
- Field parameter instruments (pH meter, thermometer, conductivity meter, turbidimeter, DO meter)
- Drums
- Marking pen for labeling drums
- Wrench for opening/sealing drums
- Decontamination supplies/equipment

3.0 PROCEDURES

3.1 Well Development

Development of all monitoring wells shall be conducted in accordance with the following procedures:

1. All monitoring well development equipment shall be decontaminated in accordance with SOP 1.5 (Decontamination) before any development activities are initiated.



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2. Well development shall occur a minimum of 24 hours after the installation of the monitoring well.
3. Collect water level measurements in accordance SOP 7.1 (Water Level Measurements).
4. Calculate the well volume in accordance with SOP 7.2 (Monitoring Well Purging with a Bailer) or 7.3 (Monitoring Well Purging with a Pump).
5. Assemble well development equipment in accordance with SOP 7.2 (Monitoring Well Purging with a Bailer) or 7.3 (Monitoring Well Purging with a Pump), depending upon the development method.
6. Begin developing the well using the development method selected.
7. Collect field parameters after each well volume in accordance with SOP 7.5 (Measurement of Monitoring Well Field Parameters) and record in logbook or on the field data sheet.
8. As purge water clears, place a surge block (or weighted bailer) in the well and lower the surge block until it is near the top of the screen or water surface. Alternately raise and lower the surge block through the vertical distance of one to two feet. The velocity of the surge block motion will depend on the tightness of the formation in which it is installed.
9. After surging the well a few times at a given depth, move the surge block deeper by one or two feet and repeat step 8.
10. Repeat steps 8 and 9 until the surge block has been lowered to the bottom of the screened section of the well.
11. Slowly raise the surge block out of the well.
12. Purge the well of sediment that may have accumulated due to the mechanical surging.
13. Repeat steps 7 through 12 until the purge water remains clear and field parameters have stabilized.
14. If the well is pumped to dryness or near dryness, the water level should be allowed to sufficiently recover (to the static water level) before the next development period is initiated. Continuous purging over a period of several days may be necessary to complete the well development.
15. All field decisions should be documented in the field log book.

3.2 Well Abandonment

Well abandonment reports should be submitted to the TCEQ by the subcontractor. Abandonment of all monitoring wells shall be conducted in accordance with the following procedures:

1. Remove all surface casing and well casing materials from the well borehole. This may be achieved either through pulling the casing or over-drilling the casing. Exceptions may be made for steel surface casings. In the event the entire length of steel surface casing cannot be pulled free, the steel casing should be cut at a depth of at least three feet below surface and this section is to be pulled free.
2. Re-drill the borehole with a bit diameter at least equal to the diameter of original to remove the sand pack, bentonite plug, and grout seal. In the event the steel surface casing cannot be removed, the bit diameter for re-drilling of the borehole shall be at least equal to the internal steel casing diameter minus one inch.
3. Pressure grout the borehole using a tremie pipe, grouting from the bottom of the borehole to the top using a cement-bentonite slurry (i.e., one 94-pound sack of Portland type II cement, 7.5 to 8 gallons of water, and 3 to 5 percent bentonite powder).



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4. Remove the well pad, protective steel casing, bumper posts, and any other ancillary well features/materials.
5. Restore the ground level at the well location to the original grade.

Any deviations from these procedures will require the approval of the TCEQ project manager.

4.0 CAUTIONS AND INTERFERENCES

A newly completed monitoring well should not be developed for at least 24 hours after installation. This will allow sufficient time for the well materials to cure before development procedures are initiated. When surging the well with a surge block, care should be taken to not damage the screen of the well while surging. Caution should be taken when using high rate pumps and/or large volume air compressors during well development because excessive high rate pumping and high air pressures can damage or destroy the well screen and filter pack.



STANDARD OPERATING PROCEDURE NO. 6.1 DOCUMENTATION AND REPORTING

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1.0 METHOD SUMMARY

This SOP provides requirements for documenting and reporting site activities. The objective of the documentation program is to accurately and completely describe all field activities, thereby demonstrating that all field activities are conducted in accordance with the project specific Field Sampling Plan or Field Work Plan and applicable Superfund Program Standard Operating Procedures (SOPs).

2.0 EQUIPMENT/APPARATUS/REAGENTS

Equipment typically required for documenting the progress of the project includes:

- Field logbook (bound, pre-paginated, all weather or water resistant)
- Field forms
- Camera
- Video recorder (if necessary)
- Permanent marking pens
- Ink pens (with permanent waterproof, black ink)

The field logbook shall contain the following information at a minimum:

- Location, date and time of each activity
- Weather conditions (changes)
- Activity being performed
- Identity of the person(s) performing the activity
- The numerical value and units of any field measurements
- The identity of, and the calibration results for, each field instrument being used
- All information required to demonstrate that the work is conducted in accordance with applicable Sampling Plans, Work Plans and SOPs
- visitors to the site
- deviations from planned activities.

Specific information which shall be included for each sample includes:

- Sample type and sampling method
- The identity of each sample and depth(s) from which it was collected
- The amount of each sample
- Sample description (e.g., color, odor, clarity)
- Identification of sampling devices
- Identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged well casings)
- All information required to demonstrate that the work is conducted in accordance with applicable Sampling Plans, Work Plans and SOPs

All information relating to installation and development of monitor wells, installation of temporary groundwater sampling points, well development, well purging, groundwater sample collection and all other sampling activities or field work shall be recorded in a field logbook or field form(s). When field forms are used the field logbook shall reference the data noted on field forms and the field forms shall be dated and signed by the author. The field logbook will be bound with consecutively numbered pages and will be suitable for submission as evidence in legal proceedings. Each entry in the field logbooks will be signed and dated by the author. All original data recorded in the field logbook and other field forms will be written



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using permanent, waterproof ink. Errors made in the field logbook will be corrected by the individual making the entry by crossing a single line through the error, entering the correct information, and dating and initialing the correction. The field logbooks and field forms will become part of the project file, and should be kept in the project file at all times when not in the possession of the field team.

Field corrective actions shall be documented in the field logbook and/or field forms. Field corrective action reports shall document the methods used when general field practices or procedures specified in the standard operating procedures were not followed. The field corrective action reports shall include the methods used to resolve a noncompliance.

3.0 PHOTOGRAPHS

General guidelines (all types of photos):

- If possible, use a camera that has a time and/or date stamp. Record the date and time each photo was taken on the photo or with the photo file (as applicable) and in the field logbook.
- Do not use special lenses (i.e., wide-angle lenses) as they can distort the image
- A brief, accurate description of what the photograph shows, including the name of the site and location shall be recorded in the field logbook.
- Include the name of the photographer, and witness, as applicable.

When photographs are taken the record of each frame exposed/recorded is kept in the bound field logbook along with the information above required for each photograph. The field investigator shall then enter the required information on the prints, slides or CD (if digital photos) using the photographic record from the bound field logbook, to identify each photograph.

Conventional 35 mm Cameras

- Obtain negatives in one continuous, uncut sheet and include with the pictures.
- Arrange photos in album format and include the above information for each photo and submit with the field logbook.

Digital Cameras

- Submit a CD-R of the downloaded picture files in JPEG format (include the above information for each photo) and submit with the field logbook.
- Digital camera recording mode (dependent on camera's pixel resolution quality and picture quality mode) shall be set to achieve a minimum pixel resolution of 1600 x 1200 or higher.

4.0 OTHER FIELD FORMS

Other types of records which may be used in the field include:

- Drum inventory forms
- Well development/purging records
- Boring logs
- Well construction diagrams (as-builts)

5.0 CAUTIONS AND INTERFERENCES

This section is not applicable to this SOP.



STANDARD OPERATING PROCEDURE NO. 6.3 VOLATILE ORGANIC COMPOUND (VOC) SAMPLES

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1.0 METHOD SUMMARY

The objective of this standard operating procedure (SOP) is to provide guidance for the sampling of volatile organic compounds (VOCs).

2.0 EQUIPMENT/APPARATUS/REAGENTS

Typical equipment required for groundwater and soil sampling includes:

- 40-mL glass vials with a PTFE-lined septum that can be hermetically sealed.
- 5-g samplers, or equivalent, and coring tool used as a transport device.
- Stir bar
- Bailer (stainless steel or disposable)
- Scoop or spatula
- 4-oz glass sample jars
- Portable balance - For field use, capable of weighing to 0.01 gram.

3.0 PROCEDURES

3.1 Water Sample Collection

The following procedures shall be followed for the collection of groundwater VOC samples. The sample volume shall be dictated in the Field Sampling Plan:

1. The 40-mL glass sample vials must be pre-cleaned and/or be certified free of VOCs.
2. Wells shall be purged in accordance with one of the following SOPs: SOP 7.2 (Monitor Well Purging with a Bailer), SOP 7.3 (Monitor Well Purging with a Pump), or SOP 7.3 (Monitor Well Micro Purging).
3. Label sample vials in accordance with SOP 6.5 (Sample Handling and Control).
4. Carefully fill a 40-mL vial with a slow, steady stream of water down the side of the vial to minimize aeration of the sample.
5. Fill the vial with water to the top so that a meniscus is formed. Allow any air bubbles to rise to the surface. Carefully and quickly screw the cap onto the container and finger tighten.
6. Invert the vial and tap it gently, looking for any air bubbles. If the sample contains air bubbles, discard the sample and repeat the sampling process with a new sampling container.
7. Refer to the site-specific field sampling plan for the site-specific sample volume. The typical sample volume for a regular water sample is three 40-mL vials. Six additional 40-mL vials are typically needed for the sample identified as the matrix spike/matrix spike duplicate (MS/MSD).
8. Preserve to a pH of 2 with HCl and cool to 4°C ($\pm 2^\circ\text{C}$) immediately after collection. DO NOT FREEZE water samples. Samples collected for determining concentrations of highly reactive VOCs, (e.g., vinyl chloride, styrene, 2-chlorovinylether, or acrylamide) will not be acid preserved and must be analyzed within seven days.
9. Package sample for shipment in accordance with SOP 6.5
10. During sample shipment, all conditions relating to the isolation/segregation of the samples from potential contaminants (gasoline/diesel engines or generators, highly contaminated samples, etc.) must be observed.



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11. Decontaminate all non-disposable sampling equipment prior to moving to new sampling point and in accordance with SOP 1.5
12. Groundwater and surface water samples for VOC analysis that are not acid preserved will be cooled in the field for transport and storage and analyzed within seven days of collection.

3.2 Soil Sample Collection

This section is based on the TCEQ Guidance on SW846-5035 and provides guidance for the implementation of Method 5035. The intent of Method 5035 is to collect the sample causing the least amount of disturbance to the soil structure and to transfer and hermetically seal the sample in a sample container as quickly as possible.

The recommended method of sample collection for both low and high concentration soils is the closed-system field collection using hermetically sealed 40-mL vials or hermetically sealed intermediate sample containers. Refer to the site-specific field sampling plan for the sample mass and equipment needed. The typical sample equipment needed for a regular soil sample is three 40-mL vials with each to hold 5-grams of soil. Six 40-mL vials are typically needed for the sample identified as the matrix spike/matrix spike duplicate (MS/MSD).

Bulk sampling can be used for sample points where contamination is expected to be high or where the procedure requires a sample volume that exceeds the recommended 5 grams, such as TCLP determination, or where a sample using Method 5035 procedures cannot be collected. Method 5035 includes a procedure for preparing low concentration samples, i.e., soil samples that can reasonably be expected to contain concentrations of VOCs between 5 mg/kg and 200 mg/kg, and a second procedure for high concentration samples, i.e., soil samples that are expected to contain greater than 200 mg/kg of VOCs.

It is recommended that screening of samples, both in the field using an appropriate field instrument and in the laboratory using a gas chromatography screening method, be conducted prior to selecting the Method 5035 option. The appropriate analytical methodology shall be dictated in the Field Sampling Plan.

3.2.1 Field procedures

This recommended sample collection technique does not require preservative.

1. The 40-mL amber glass sample vials must be pre-cleaned and/or be certified free of VOCs.
2. Sample vials should be prepared in a fixed laboratory or other controlled environment. The tare weight of the sample vial including cap, septum, and label must be determined and recorded on the label prior to shipping the vials to the field for sample collection. Clean gloves should be worn when handling tared vials.
3. Exposure to air must be minimized by obtaining the sample directly from the source media using a coring device or a commercially designed sampling device and by transferring the sample as quickly as possible to a vial (or sealing the sample borer/hermetically sealed sample container immediately). The vial should be quickly wiped free of any particulate matter that would compromise the integrity of the vial seal. Fingers should be used to minimize exposure to air by forming a temporary seal between the vial and the sampling device. The coring/sampling device must be designed to fit tightly against the mouth of the vial or be small enough to be inserted into the vial. The vial must be hermetically sealed immediately after placing the sample in the vial.



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4. The coring device can be used to collect multiple aliquots from the same sample point provided the integrity of the coring device is not compromised. If the coring device is designed and approved to be used as a temporary storage device for transport to the laboratory, the manufacturer's instructions should be followed. If a bulk sample is being collected because the concentrations in the soil are considered high, a 4-oz sample jar should be filled to capacity to minimize the head space in the sample container.
5. Refer to the site-specific field sampling plan for the site-specific sample mass needed. The typical sample size collected should be three aliquots, approximately 5 grams (10 grams for TPH analysis by TCEQ 1005 and 1006) each. Typically, six aliquots are collected at each sample point for matrix spike/matrix spike duplicate (MS/MSD) sampling. The coring device should be calibrated to the required sample size and designed to minimize the disturbance of the sample during collection. Several calibrated coring devices are available commercially. When practical, use a portable balance to weigh the sealed vial containing the sample to ensure that 5.0 ± 0.5 grams of sample were added. For non-cohesive soils and waste (e.g., dry sand, fly ash, etc.), highly cohesive materials (e.g., concrete, rock, etc), and soils that have high compressive and shear strength, the sample should be quickly transferred into a 4-oz jar using a scoop or spatula. Enough sample should be collected such that the head space in the jar is minimized.
6. A bulk sample with no preservative should be collected to use for screening purposes in the laboratory, but not for quantitative analysis. After the sample is screened in the laboratory, the sample can be used to determine the percent moisture, to run the MS/MSD, to check reactivity with sodium bisulfate, and/or to determine the appropriate extraction solvent, as necessary.
7. For the samples with high concentrations of VOCs, the sample is extracted with methanol and the extract is used for dilutions and/or re-analysis. Therefore, only two aliquots are recommended, one aliquot for analysis and one aliquot for re-analysis, if necessary. If the VOC concentration is unknown, collect three aliquots.
8. Sample containers remain unopened from the time of collection until analysis.
9. The use of a balance in the field is required to check the tare weight when field preservation with methanol is being conducted. For other sample collection procedures, balances are used to verify that an adequate volume (weight) of soil is collected, because the initial soil sample size will affect the quantitation limit that can be achieved on the sample.
10. All samples must be properly packaged (SOP 6.4) and chilled to 4°C ($\pm 2^\circ\text{C}$) immediately upon collection.
11. During sample shipment, all conditions relating to the isolation/segregation of the samples from potential contaminants (gasoline/diesel engines or generators, highly contaminated samples, etc.) must be observed.
12. Decontaminate all non-disposable sampling equipment prior to moving to another well and/or at the end of the day.

3.2.2 Quality Control

The laboratory quality control measures specified throughout Method 5035 must be followed. Field quality control measures should include a trip blank in every sample shuttle that contains samples for volatile analysis regardless of the sample collection technique.



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4.0 CAUTIONS AND INTERFERENCES

4.1 Groundwater Sample Collection

Make sure that there are no air bubbles in the sample bottle. Be careful not to agitate the sample. The sample bottle should be quickly sealed, chilled to 4°C ($\pm 2^\circ\text{C}$), and shipped to the laboratory.

4.2 Soil Sample Collection

The recommended method of sample collection for both low and high concentration soils is to collect the sample using a coring device and to quickly extrude the sample core into a tared 40-mL vial that does not contain preservative but does contain the stir bar, if applicable. The threads of the vial are inspected and wiped clean, and the vial is quickly sealed and chilled, held at 4°C ($\pm 2^\circ\text{C}$), and shipped to the laboratory. The laboratory should analyze the sample within 48 hours from the time of collection. Alternatively, the laboratory can preserve the sample within the 48 hour time frame to extend the holding time to 14 days. The manual addition of any water, surrogates, and/or internal standards, and all additions of preservatives should be made using a 22-gauge or thinner needle through the septum seal. This collection procedure does not require the use of preservatives in the field or balances in the field. An alternative method is the collection of the sample using an approved coring device that serves as an intermediate hermetically sealed sample container. This type of sampling device should be used according to the manufacturer's instructions.



STANDARD OPERATING PROCEDURE NO. 6.4 SAMPLE HANDLING AND CONTROL

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1.0 METHOD SUMMARY

This SOP presents procedures for maintaining control of environmental samples following collection through shipment to the analytical laboratory. In addition, this SOP describes standard chain-of-custody protocols which should be followed to document the possession of samples from the time of collection until the laboratory report is submitted.

2.0 EQUIPMENT/APPARATUS/REAGENTS

Equipment needed for use in this SOP includes:

- Pre-cleaned sample containers
- Preservatives (if not in containers)
- Sturdy cooler, in good repair
- Fiberglass strapping tape
- Duct tape
- Clear tape
- Bubble wrap or other packing material
- Ziploc-type bags
- Trash bags
- Ice
- Shipping labels
- Pens, markers, etc.

3.0 PROCEDURES

3.1 Sample Packaging

Environmental samples should be packed prior to shipment using the following procedures:

1. Allow sufficient headspace (approximately 10 percent of the volume of the container) in all bottles (except volatile organic analysis (VOA) vials with a septum seal) to compensate for any pressure and temperature changes which may occur during shipment.
2. Ensure that the lids on all bottles are tight.
3. Select a sturdy cooler in good repair. Secure and tape the drain plug with fiberglass strapping tape or duct tape. Line the cooler with a heavy duty plastic garbage bag.
4. Place glass sample bottles into bubble wrap bags or wrap a layer of bubble wrap around glass containers. Many laboratories provide bubble wrap bags for sample shipment. Place two to three VOA vials in a single bag.
5. Place the bottles in the cooler with larger bottles on the bottom inside the garbage bag. Insert polyethylene bottles between glass bottles for cushion. Put VOA vials (in bubble wrap bags) on their side on top of the larger sample containers.
6. Ensure that a trip blank has been included as appropriate for VOA samples and that a temperature blank (if supplied) is included as outlined in SOP No. 6.3, and SOP No. 6.5.
7. Place ice that has been double bagged on top of and/or between the samples. Fill remaining void space in the cooler with bubble wrap. Ensure that a sufficient quantity of ice has been placed into the cooler to maintain VOC samples at 4°C. In summer months, it may be necessary to fill as much as 50 percent of the cooler volume with ice to properly cool warm samples.
8. Securely fasten the top of the garbage bag with tape.



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9. Place the Chain-of-Custody record into a Ziploc-type bag and tape the bag to the inside of the cooler lid.
10. Close the cooler and securely tape (preferably with fiberglass strapping tape) the top of the cooler shut. Chain-of-custody seals (preferably two) should be affixed to the cooler with clear tape so that the cooler can not be opened without breaking the seals.
11. Place the shipping label in a sealed pouch on the lid of the cooler for shipment. A label containing the name and address of the shipper and the destination should be placed on the outside of each additional cooler included in the shipment.

3.2 Sample Shipping

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible (within 24 hours of sampling) to avoid hold time exceedances and to ensure that samples remain properly preserved. Samples for VOC analysis must be maintained at a temperature of 4°C.

In general environmental samples include drinking water, most ground water and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, biological specimens, or any samples not expected to be contaminated with high levels of hazardous materials. Samples collected from process wastewater streams, drums, bulk storage tanks, soil, sediment, or water samples from areas suspected of being highly contaminated may require shipment as dangerous goods. Regulations for packing marking, labeling, and shipping of dangerous goods by air transport are promulgated by the International Air Transport Authority (IATA), which is equivalent to United Nations International Civil Aviation Organization (UN/ICAO). It is the responsibility of the shipper to ensure that shipments are made in accordance with all applicable laws, including contents and labeling.

3.3 Sample Chain-of-Custody

Procedures to ensure the custody and integrity of the samples should begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field laboratory records.

The contractor shall maintain chain-of-custody records for all field and field QC samples. A sample is defined as being within a person's custody if any of the following conditions exist:

- It is in their possession,
- It is in their view,
- It was in their possession and they secured it in a locked area, or
- It is in a designated secured area.

All sample containers shall be sealed in a manner that shall prevent or provide detection of tampering if it occurs. In no case shall tape be used to seal sample containers. Samples shall not be packaged with activated carbon unless prior approval is obtained from TCEQ.

The following minimum information concerning the sample shall be documented on the TCEQ chain-of-custody form (Attachment 1):

- Unique sample identification
- Date and time of sample collection
- Source of sample (including name, location, and sample type)



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- Designation of matrix spike/matrix spike duplicate (MS/MSD)
- Preservative used
- Analyses required
- Number of sample containers
- Pertinent field data (pH, temperature, elevated headspace results or contaminant concentrations)
- Serial numbers of custody seals and transportation cases (if used)
- Name(s) of person(s) collecting the samples
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories
- Transporter tracking number (if applicable) or courier receipts

4.0 CAUTIONS AND INTERFERENCES

This section is not applicable to this SOP.

CHAIN OF CUSTODY RECORD

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Project Name				Project No.				Analytical Parameters												Remarks		
Project Location				Project Manager																		
Sampler(s)																						
Sample		Type		Sample Identification	Matrix	Containers																
Date	Time	Com p.	Grab			No.	Type															
Signatures						Date	Time	Shipping Details						Special Instructions								
Relinquished by:								Method of Shipment														
Received by:								Airbill No.														
Relinquished by:								Lab Address														



STANDARD OPERATING PROCEDURE NO. 6.4

SAMPLE HANDLING AND CONTROL

Received for Laboratory by:

Custody.frm/jdg 3-09-92

White copy - Laboratory



STANDARD OPERATING PROCEDURE NO. 6.5 QUALITY CONTROL SAMPLES

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1.0 METHOD SUMMARY

Quality control (QC) samples are collected to determine if sample bottle preparation, shipment, handling, and storage procedures result in contamination or other effects on environmental samples. QC samples include:

- Equipment Blanks.
- Trip Blanks.
- Field Blanks.
- Temperature Blanks.
- Field Duplicate Samples.
- Field Split Samples.
- Matrix Spike/Matrix Spike Duplicates (MS/MSD).

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following equipment is used for collection of QC samples:

- Pre-cleaned sample containers (with preservatives, if required)
- ASTM Type II reagent grade water
- Stainless steel sampling bowl
- Stainless steel sampling spoon
- Other equipment as prescribed for collecting samples

3.0 PROCEDURES

3.1 EQUIPMENT BLANKS

Equipment blanks are used to assess the effectiveness of equipment decontamination procedures. An equipment blank (also known as a rinsate blank) is a sample of ASTM Type II reagent grade water poured into, over, or pumped through the sampling device; collected in a sample container; and transported to the laboratory for analysis. These blanks are collected immediately after the equipment has been decontaminated and are analyzed for all laboratory analyses requested for the environmental samples collected with that equipment.

FREQUENCY

Equipment blanks are not collected from disposable or dedicated (e.g., a monitoring well bailer dedicated to a single well) equipment. They are collected at a frequency of one blank per equipment type, per environmental media, per day.

PROCEDURE

Equipment blanks should be collected using the following procedures:



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1. Properly decontaminate the sampling device [see SOP 1.5 (Decontamination)].
2. Select the proper sample containers and an appropriate quantity of ASTM Type II reagent grade water.
3. Complete the sample labels with the appropriate information.
4. Slowly pour the ASTM Type II reagent grade water through or over the sampling device until the sample bottle is filled to the appropriate level.
5. Securely tighten the cap on the bottle.
6. Prepare the bottle for shipment in accordance with SOP 6.4 (Sampling Handling and Control).

DATA EVALUATION

Contamination detected in the equipment blank may indicate that contamination was introduced by the sampling equipment. If the same analytes are found in the field samples, these analytes may represent contamination originating from the sampling equipment.

3.2 TRIP BLANKS

Samples can be contaminated by diffusion of volatile organic compounds (VOCs) through the septum seal into the sample during storage, shipping, and handling. Contamination may also be present in the bottles used to contain the sample or in the reagent grade water.

Trip blanks are used to assess the potential introduction of VOC contaminants to the sample during sample handling, transportation, and storage. They consist of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. The trip blank is shipped and stored with VOC water samples and should not be opened in the field.

FREQUENCY

Trip blanks are prepared only when VOC samples are collected and are analyzed only for VOC analytes. One trip blank should be included in each sample cooler containing samples for VOC analysis.

PROCEDURE

The procedures for submitting a trip blank are:

1. Prepare the coolers for shipment to the laboratory. If possible, pack all samples for VOC analysis in one cooler so that only one trip blank is required.
2. Identify the trip blank on the chain-of-custody record. If the project will continue for several days, be sure to number trip blanks sequentially so that multiple trip blanks with the same identification number are not submitted to the laboratory.



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DATA EVALUATION

Contamination detected in the trip blank may indicate that contamination was present in the sample bottles or was introduced during sample handling. If the same analytes are found in the field samples, these analytes may represent contamination introduced during sample handling, transportation, or storage.

3.3 FIELD BLANKS

Field blanks are used to assess the potential introduction of contaminants from field sources (e.g., gasoline motors in operation) to the samples during sample collection. A field blank consists of ASTM Type II reagent grade water poured into a VOC sample vial at the sampling site (in the same vicinity as the associated samples). Field blanks must be collected downwind of possible VOC sources. The field blank is handled like an environmental sample and transported to the laboratory for analysis.

FREQUENCY

Field blanks are prepared only when VOC samples are collected and are analyzed only for VOC analytes. They are collected at a frequency of one blank per 20 VOC samples for each matrix.

PROCEDURE

The procedures for collecting field blanks are:

1. Select the proper sample containers (VOC vials) and an appropriate quantity of ASTM Type II reagent grade water.
2. Complete the sample labels with the appropriate information.
3. Pour the ASTM Type II reagent grade water into the vial just to overflowing so that there is a meniscus at the top of the vials.
4. Securely tighten the lid on the sample vials.
5. Prepare the sample for shipment in accordance with SOP 6.4 (Sampling Handling and Control).

DATA EVALUATION

Contamination detected in the field blank may indicate that VOC contamination was introduced from field sources. If the same analytes are found in the field samples, these analytes may represent contamination introduced during sample collection, transportation, or storage.

3.4 TEMPERATURE BLANKS

Temperature blanks are prepared by the analytical laboratory and included in the shipment of sample coolers and containers. They are used to determine the temperature of the environmental samples upon receipt by the laboratory.



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FREQUENCY

A temperature blank will be included with each cooler sent to the laboratory with environmental samples.

PROCEDURE

Temperature blanks are typically prepared by the analytical laboratory and included in the shipment of sample coolers and containers. The temperature of temperature blank samples is measured by the laboratory upon receipt of environmental samples.

DATA EVALUATION

Excessive temperature in the blank may indicate the potential for analyte loss or degradation prior to sample analysis.

3.5 FIELD DUPLICATE SAMPLES

Field duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. Locations for field duplicate samples should be designated prior to field work but should be adjusted in the field based on field observations. **They are shipped “blind” to the laboratory (the nomenclature used to identify the duplicate sample does not reveal to the laboratory that the sample is part of a field duplicate pair).**

3.6 FIELD SPLIT SAMPLES

Field split samples are collected by retrieving double sample volume from the environmental matrix from one location, fully homogenizing the complete volume, and from that homogenized volume collecting two separate aliquots. Each aliquot is given a unique sample number. Field split samples are intended **to evaluate laboratory precision if sent “blind” to the same laboratory.** Field split samples are intended to evaluate inter-laboratory precision if the samples are sent to separate laboratories and each laboratory performs the same analysis using the same standard operating procedure(s) for the preparation and analysis of the sample.

FREQUENCY

The frequency of collection of field duplicates is specified in the FSP.

PROCEDURE

The procedures for collecting field duplicates are:

1. Select the proper sample containers for collecting two samples.
2. Complete the sample labels with the appropriate information.



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3. Specify the locations designated for the collection of field duplicate samples. (If possible, collect field duplicate samples in areas known to be contaminated to assess the laboratory's ability to measure contamination).
4. Collect the sample as required.
 - a. Groundwater Samples
 - i. Collect the sample in accordance with the appropriate sampling SOP.
 - ii. Fill the first sample bottle half full with the pump or bailer then fill the second sample bottle half full. Fill the remainder of each sample bottle beginning with the first bottle. If a bailer is used, attempt to fill equal quantities from each bailer load into both bottles.
 - b. Soil Samples
 - i. Collect double the required volume of soil for a normal sample in accordance with the appropriate sampling SOP.
 - ii. Place the soil in a stainless steel bowl and mix the sample with a stainless steel spoon. Do not mix samples for VOC analysis as the mixing process may cause a release of VOCs.
 - iii. Arrange the soil into quarters within the sample bowl and set aside two of the quarters.
 - iv. Mix the sample again.
 - v. Fill the appropriate sample jars using the material from the bowl, placing equal portions of soil in the each bottle.
5. Securely tighten the caps on the sample bottles.
6. Prepare the sample for shipment in accordance with SOP 6.5 (Sampling Handling and Control).

DATA EVALUATION

Field duplicate sample results may be used to assess total precision, which includes the inherent spatial variability of contaminants in the field, the sample collection process, any mixing process employed, and the laboratory extraction and analysis process. The two largest components of variability (imprecision) are the inherent spatial variability of contaminants in the field and the mixing process. These two components of variability cannot be assessed separately from the other components of variability through the collection of low numbers of field duplicate samples. There are no corrective actions for the failure to achieve duplicate goals.

Field duplicate sample collection and analyses result in two equally valid analytical results (hence the term **“duplicate”**). **Neither the “original” sample nor the “duplicate” sample is more** valid than the other. Therefore, both sample results should be considered in environmental projects. As listed below, several options are available depending on the situation and the goal of the project:

1. Use both sample results;
2. Use the mean of the two sample results; or



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3. Use the maximum of the two sample results.

3.6 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD)

A matrix spike is a measured, known amount of target analyte which is added to a sample prior to extraction and analysis in order to determine the effects the sample matrix (e.g., soil, waste, or water) has on the recovery of contaminants.

Frequently the sample to be used for spiking is split into three aliquots, two of which are spiked with known concentrations of contaminants. Many laboratories can prepare the MS/MSD samples from the submitted sample volume, while others may require additional (e.g. triplicate) volume. The two spiked aliquots are known as the matrix spike (MS) and the matrix spike duplicate (MSD) sample.

The MS and MSD are spiked at a level less than or equal to the midpoint of the calibration curve for each analyte identified in the FSP. When the contaminants are not identified in the FSP, the MS/MSD are spiked **with a subset of the analytes included in the laboratory's initial calibration standard mixture(s)** that are representative of the range and characteristics of the calibrated analytes. All three aliquots are analyzed.

The choice of which sample to select for the MS/MSD analysis is important. If left up to the laboratory, a relatively contaminant-free sample, which is likely to provide good matrix spike recoveries, may be selected. This practice circumvents the primary purpose of the MS/MSD analysis, which is to assess matrix effects that may be associated with samples from a site. Therefore, the sample to be used for the MS/MSD should be designated by the field team from likely contaminated areas; however, source areas or sample locations with known high concentrations should not be selected for the MS/MSD analysis. Only TCEQ project samples should be used for the MS/MSD on Superfund projects.

FREQUENCY

One MS/MSD sample will be designated for every 20 environmental samples per environmental medium.

PROCEDURE

The following procedures apply to MS/MSDs:

1. Contact the laboratory to confirm the necessary volume for MS/MSD samples.
2. Plan which field locations will be appropriate to collect MS/MSD samples.
3. Collect the required volume for the designated sample(s).
4. Identify the MS/MSD and associated parent sample on the chain of custody.
5. Ship the sample with other environmental samples.
6. Confirm that the TCEQ samples were analyzed as the MS/MSD at the required frequency.

DATA EVALUATION



STANDARD OPERATING PROCEDURE NO. 6.5 QUALITY CONTROL SAMPLES

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Percent recoveries are calculated for each of the spiked analytes to give an indication of how the matrix is affecting the reported concentrations (i.e. the direction and magnitude of any potential bias to the reported sample results). The relative percent difference (%RSD) between the MS and the MSD is calculated to assess the analytical precision of the laboratory. TCEQ does not use the MS/MSD to control the analytical process.

4.0 CAUTIONS AND INTERFERENCES

The types of QC samples and frequency for collection are outlined in the project Quality Assurance Project Plan (QAPP). It is important to identify the sample frequency in the Field Sampling Plan (FSP). QC samples should be selected to match the sampling program (i.e., it is not necessary to collect trip blanks for sites where only samples for metals analysis are being collected).



STANDARD OPERATING PROCEDURE NO. 7.1 WATER LEVEL/SEDIMENT MEASUREMENT

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1.0 METHOD SUMMARY

An accurate water level measurement is necessary to calculate purge volumes and to create water level surface maps. This SOP describes the steps necessary to collect a water level/sediment level from a monitoring well.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for water level/sediment measurement of groundwater monitoring wells.

2.1 Equipment List

- Water level indicator
- Well keys
- PID or FID
- Logbook
- As-built diagrams of monitoring wells
- Calculator
- Plastic sheeting
- Bolt cutters
- Cotton string
- Clear bailers
- Nylon rope
- Weights
- Appropriate personal protective equipment (PPE)

3.0 PROCEDURES

3.1 Water level/Sediment Measurement

1. Start at the least contaminated well, if known.
2. Inspect the well for signs of tampering or other damage. If tampering is suspected, (i.e., casing is damaged, lock or cap is missing) this shall be recorded in the field log book and on the well sampling form and reported to the Field Operations Leader. Wells that are suspected to have been tampered with shall not be sampled until the Field Operations Leader has discussed the matter with the project manager.
3. Lay plastic sheeting around the well to minimize likelihood of contamination of equipment from soil adjacent to the well.
4. Remove locking well cap, note location, time of day, and date in field notebook or appropriate log form.
5. Remove well casing cap.
6. For confined aquifers, wait for water level to equilibrate before measuring water level.
7. Turn on the water level meter.
8. Press the battery check button (if so equipped). A solid tone will be heard if the battery is good.
9. Lower water level measuring device or equivalent (i.e., permanently installed transducers or airline) into well, unreeling the measuring tape from the spool of the meter as you go.
10. Continue lowering the probe until a continuous tone is heard. This tone indicates that the probe has come in contact with the water.



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11. Holding the measuring tape near the measuring reference point, alternately raise and lower the probe across the depth at which the tone sounds. This will ensure that you have an accurate measurement of the depth to water. Record the distance from water surface to the referenced measuring point on well casing in site logbook. Alternatively, if there is no reference point, note that water level measurement is from top of steel casing, top of PVC riser pipe, from ground surface, or some other position on the wellhead, typically on the north edge. Water level measurement should be recorded to the nearest 0.01 foot.
12. Measure total depth of well (at least twice to confirm measurement) and record in the site logbook or field data sheet. Total depth measurements should be recorded to the nearest 0.01 foot..
13. If the field investigator suspects that excessive sediment buildup may be occurring at the bottom of the well, the measured total depth should be compared with the total depth at the time of drilling (from boring log). If the sediment thickness exceeds one foot, or is excessively impeding the flow of groundwater through the well screen, the well shall be redeveloped in accordance with SOP 5.6 (Monitor Well Development/Abandonment).
14. Decontaminate water level probe in accordance with SOP 1.5 (Decontamination).

3.2 Measurement of Separate Phase Liquids (DNAPL or LNAPL)

Separate phase organics frequently occur at hazardous waste sites as light non-aqueous phase liquids (LNAPL) or dense non-aqueous phase liquids (DNAPL). The presence of these constituents should be documented if possible. The presence of LNAPL can be confirmed using a clear bailer by lowering the bailer to just below the top of the water surface, removing the bailer, and observing the contents. The volume of LNAPL recovered can be enhanced through the use of a product cup. The presence of DNAPL can be confirmed by one of two ways.

1. Lower a weighted bailer to the bottom of the well, remove the bailer and observe the contents for any free product.
2. Lower a length of weighted cotton string to the bottom of the well, remove the string and observe the string for the DNAPL staining.
3. Measure and record the thickness of any free product identified to the nearest 0.01 ft.

4.0 CAUTIONS AND INTERFERENCES

Water levels in wells should be measured from the least contaminated to the most contaminated or from upgradient to downgradient if chemistry is unknown.



STANDARD OPERATING PROCEDURE NO. 7.3 PURGING A MONITORING WELL WITH A PUMP

SOP#: 7.3
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1.0 METHOD SUMMARY

Purging is the process of removing stagnant water from a monitoring well, immediately prior to sampling, causing its replacement by groundwater from the adjacent formation, which is representative of actual aquifer conditions. If a monitor well is pumped or bailed dry, it will be allowed to recover to 85 percent of the original water volume before sample collection. If the monitor well does not recover to within 85 percent of the original water volume within 24 hours, but a sufficient volume of water is present to collect a sample, the sample will be collected from the available water and the volume of water will be recorded in the field logbook. If the monitoring well is to be purged and sampled using micro purging and low-flow sampling techniques, refer to SOP 7.4 – Micro Purging a Monitoring Well.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for purging groundwater monitoring wells a pump.

2.1 Equipment List

- Logbook
- As-built diagrams of monitoring wells
- Calculator
- Field data sheets
- 5-gallon buckets
- Plastic sheeting
- Generator, if using pump
- Air compressor for bladder pumps
- Pump
- Gasoline for generator/air compressor
- Discharge tubing for pump
- Control box (if necessary)
- Appropriate pump fittings (e.g., hose clamps, barbed fittings, etc.)
- Drums
- Marking pen for labeling drums
- Wrench for opening/sealing drums
- Appropriate PPE

3.0 PROCEDURES

1. Determine the diameter of the well in inches.
2. Select the "Gallons/Linear Foot of Water Column" from Table 1 corresponding to the diameter of the well.

Table 1 Well Casing Diameter versus Volume of Water	
Well Casing Diameter	Gallons/Linear Foot of Water Column
1	0.041
2	0.163
3	0.367
4	0.653
5	1.02
6	1.469
7	1.999
8	2.611
9	3.305
10	4.08



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3. Measure the water level in the well in feet [as described in SOP 7.1 (Water Level/Sediment Measurement)].
4. Determine the total depth of the well in feet.
5. Determine the height of the water column in the well in feet (H = height of water column (feet), calculated by subtracting the depth to water from the total depth of the well); the volume of water in the well includes the water in the casing and in the annular space.
6. Determine the purge volume using Equation 1 (the purge volume is determined as three times the calculated volume of water in the well).

Equation 1:

$$\text{Purge Volume} = H \times (\text{selected Gallons/Linear Foot of Water Column}) \times 3$$

Where H = height of water column

7. All non-dedicated equipment shall be decontaminated in accordance with SOP 1.5 (Decontamination) prior to sampling activities.
8. Assemble pump, hoses and safety rope, and lower the pump into the well. Make sure the pump is deep enough so all the water is not evacuated; running the pump without water may cause damage.
9. Make connections between the pump and control box if using an air-lift or bladder pump (e.g., Well Wizard).
10. Attach flow meter to the outlet hose to measure the volume of water purged.
11. Use a ground fault circuit interrupter (GFCI) or ground the generator to avoid possible electric shock.
12. Attach power supply, and begin purging the well. The well should be purged at a rate low enough to prevent water from cascading down the sides of the well, if at all possible. Do not allow the pump to run dry.
13. If the pumping rate exceeds the well recharge rate, lower the pump further into the well, reduce the pumping rate to decrease well drawdown, and continue pumping.
14. If using an air-lift or bladder type pump, be sure to adjust flow rate to prevent violent jolting of the hose as sample is drawn in.
15. Purge water should be handled in accordance with SOP 1.4 (Management of Investigation-Derived Waste) and the site-specific field sampling plan.
16. When no sediments are visible in the purge water, begin measuring field parameters in accordance with SOP 7.5 (Measurement of Field Parameters).
17. Purge the well until the purge volume has been achieved and the well parameters have stabilized. As a general rule, all monitoring wells should be pumped or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan. Evacuation of a minimum of one borehole volume, and preferably three to five volumes, is recommended for a representative sample.



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4.0 CAUTIONS AND INTERFERENCES

The primary goal in performing groundwater sampling is to obtain a representative sample of the groundwater body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel. While laboratory methods have become extremely sensitive, well controlled and quality assured, they cannot compensate for a poorly collected sample. The collection of a sample should be as sensitive, highly developed and quality assured as the analytical procedures.

In a non-pumping well, there will be little or no vertical mixing of the water, and stratification will occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated, become stagnant, and may lack the contaminants representative of the groundwater. Persons sampling should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface resulting in an unrepresentative sample. To safeguard against collecting nonrepresentative stagnant water, the following guidelines and techniques should be adhered to during sampling:

1. Water level and sediment thickness measurements should be taken prior to beginning the purging activities.
2. As a general rule, all monitoring wells should be pumped (preferred) or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan.
3. A non-representative sample can result from excessive pre-pumping of the monitoring well. Stratification of the leachate concentration in the groundwater formation may occur, or heavier-than-water compounds may sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

Materials of construction for samplers and evacuation equipment (bladders, pump, bailers, tubing, etc.) should be limited to stainless steel, Teflon, and glass in areas where concentrations are expected to be at or near the detection limit. The tendency of organics to leach into and out of many materials makes the selection of materials critical for trace analyses. The use of plastics, such as PVC or polyethylene, should be avoided when analyzing for organics. However, PVC may be used for evacuation equipment as it will not come in contact with the sample, and in highly contaminated wells, disposable equipment (e.g., polypropylene bailers) may be appropriate to avoid cross-contamination.



STANDARD OPERATING PROCEDURE NO. 7.4 MICRO PURGING A MONITORING WELL

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1.0 METHOD SUMMARY

Micro purging is an approach to purging based on the observation that groundwater flows through the well screen in most formations with sufficient velocity to maintain an exchange with formation water surrounding the well screen. By placing a pump within the screen interval and pumping at a low-flow rate which does not induce drawdown of the water column, a representative sample of formation groundwater can be collected with minimal withdrawal of stagnant water. Ideally micro purging should be conducted in wells in which dedicated pumps have been installed. It is possible to use non-dedicated pumps if a sufficient amount of time is allowed for the water level to equilibrate following insertion of the pump. Whenever possible, micro purging and low-flow sampling methods are preferred for use at Superfund sites. If a monitor well is pumped or bailed dry, it will be allowed to recover to 85 percent of the original water volume before sample collection. If the monitor well does not recover to within 85 percent of the original water volume within 24 hours, but a sufficient volume of water is present to collect a sample, the sample will be collected from the available water and the volume of water will be recorded in the field logbook.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for micro purging groundwater monitoring wells.

Equipment List

- Logbook
- As-built diagrams of monitoring wells
- Field data sheets
- Plastic sheeting
- Generator, if using pump
- Air compressor for bladder pumps
- Pump
- Gasoline for generator or an electrical source
- Discharge tubing for pump
- Control box (if necessary)
- Appropriate pump fittings (e.g., hose clamps, barbed fittings, etc.)
- Drums
- Marking pen for labeling drums
- Wrench for opening/sealing drums
- Appropriate PPE

3.0 PROCEDURES

The procedures for micro purging are as follows:

1. All non-dedicated equipment shall be decontaminated in accordance with SOP 1.5 (Decontamination) prior to sampling activities.
2. Assemble pump, hoses and safety cable, and, if using a non-dedicated pump, lower the pump into the well. The pump intake should be set in the middle or slightly above the middle of the screened interval. Alternatively, the pump may be located adjacent to the zone of highest contamination, if well-documented for reproducibility; however, placement of the pump too close to the bottom of the well may result in increased entrainment of solids which have accumulated in the well over time.



STANDARD OPERATING PROCEDURE NO. 7.4 MICRO PURGING A MONITORING WELL

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Placement of the pump at the top of the water column, just below the air/water interface is only recommended in unconfined aquifers where the water table straddles the screen or where this is the desired sampling point.

3. If using a non-dedicated pump, allow sufficient time for the water level to equilibrate to obtain a representative sample.
4. Make connections between the pump and control box if using an air-lift or bladder pump (i.e., Well Wizard).
5. Use a ground fault interrupter (GFCI) or ground the generator to avoid possible electric shock.
6. Attach power supply and begin micro purging the well. A well should be purged at or below its recovery rate, ideally less than 0.2 to 0.3 L/min.
7. Monitor the drawdown in the well. If the drawdown exceeds 0.3 ft, then reduce the pumping rate to ensure that drawdown does not exceed 0.3 ft.
8. Connect the water quality meters to the discharge hose and measure field parameters in accordance with Section 7.5 (Measurements of Monitor Well Field Parameters).
9. Repeat the measurements at a regular interval (i.e., every minute). Record the values in the field log book. Continue purging until the measured parameters stabilize for 3 successive readings.
10. If field parameters have not stabilized after 3 successive readings, continue taking measurements at 3 minute intervals up to a maximum of 5 successive readings. If, after 5 successive readings, the parameters have not stabilized, an entry shall be made in the field logbook indicating that sampling will be conducted without stabilized parameters.
11. Purge water should be containerized on site or handled as specified in the site specific project plan.

4.0 CAUTIONS AND INTERFERENCES

The primary goal in performing groundwater sampling is to obtain a representative sample of the groundwater body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel. While laboratory methods have become extremely sensitive, well controlled and quality assured, they cannot compensate for a poorly collected sample. The collection of a sample should be as sensitive, highly developed and quality assured as the analytical procedures.

In a non-pumping well, there will be little or no vertical mixing of the water, and stratification will occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated, become stagnant, and may lack the contaminants representative of the groundwater. Persons sampling should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface resulting in an unrepresentative sample. To safeguard against collecting stagnant water, the following guidelines and techniques should be adhered to during sampling:

1. Water level and sediment thickness measurements should be taken prior to beginning the purging activities.



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2. As a general rule, all monitoring wells should be pumped (preferred) or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan.
3. For wells that can be easily pumped or bailed to dryness, micro purging and low-flow sampling methods shall be used.

Materials of construction for samplers and evacuation equipment (bladders, pump, bailers, tubing, etc.) should be limited to stainless steel, Teflon, and glass in areas where concentrations are expected to be at or near the detection limit. The tendency of organics to leach into and out of many materials makes the selection of materials critical for trace analyses. The use of plastics, such as PVC or polyethylene, should be avoided when analyzing for organics. However, PVC may be used for evacuation equipment as it will not come in contact with the sample, and in highly contaminated wells, disposable equipment (i.e., polypropylene bailers) may be appropriate to avoid cross-contamination.



STANDARD OPERATING PROCEDURE NO. 7.5 MEASUREMENT OF FIELD PARAMETERS

SOP#: 7.5
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1.0 METHOD SUMMARY

Field parameters are collected during surface water or groundwater sampling events to identify physical/chemical characteristics of the sample that are representative of field conditions as they exist at the time of sample collection. They are also used to indicate when stagnant water has been removed from the well so that sampling may begin. Numerous instruments are commercially available for measuring field parameters. The setup and use of all instruments should follow a basic format to imply consistency of use. Regardless of the brand of meter used, all meters should be properly maintained and operated in accordance with the manufacturer's instructions and calibrations should be checked prior to use.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for measuring field parameters:

2.1 Equipment List

- Logbook
- Field data sheets
- Decontamination solutions
- Tap water
- Field parameter instruments (pH meter, thermometer, conductivity meter, turbidimeter, DO meter)
- Calibration standards
- Tap water
- Non-phosphate soap (Note: Alconox is not considered a non-phosphate soap; rather a low-phosphate soap)
- Glass bulb thermometer

3.0 PROCEDURES

3.1 Temperature

Temperature is a measure of hotness or coldness on a defined scale as measured using a thermometer. Typical types of thermometers include:

- Digital (thermo-couple) thermistor
- Glass bulb mercury filled
- Bi-metal strip/dial indicator

No matter which type of thermometer is used, it should be calibrated prior to use, if possible. Digital thermometers should be calibrated prior to use by comparison with a mercury bulb thermometer and should agree within $\pm 0.5^{\circ}\text{C}$.

The procedures for measuring temperature are as follows:

1. Clean the probe end with analyte-free water and immerse into sample.
2. Swirl the thermometer in the sample.
3. Allow the thermometer to equilibrate with the sample.
4. Suspend the thermometer away from the sides and bottom to observe the reading.
5. Record the reading in the field log book or on the appropriate sampling log sheet. Units of temperature are degrees Celsius ($^{\circ}\text{C}$) and should be recorded to the nearest tenth (0.1).

Conversion Formulas:

$$^{\circ}\text{F} = (1.8^{\circ}\text{C}) + 32^{\circ} \quad \text{or} \quad ^{\circ}\text{C} = 0.56 (^{\circ}\text{F} - 32^{\circ})$$



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3.2 pH

Hydrogen ion concentration (pH) is used to express both acidity and alkalinity on a scale which ranges from 0 to 14 with 7 representing neutrality.

The procedures for measuring pH in the field are as follows:

1. Calibrate the instrument in accordance with the manufacturer=s specifications.
2. Collect a sample. Measure the temperature prior to measuring the pH.
3. Immerse the probe in the sample, keeping it away from the sides and bottom of the sample container. Allow ample time for the probe to equilibrate with the sample.
4. While suspending the probe away from the sides and bottom of the sample container, record the pH. Units of pH are standard units and should be recorded in tenths (0.1).
5. Rinse the probe with analyte-free water and store it in an analyte-free water filled container until the next sample is ready.
6. Perform a post calibration at the end of the day and record all findings.

3.3 Conductivity

Conductivity is defined as the quality or power of conducting or transmitting. The procedures for measuring conductivity in the field are as follows:

1. Calibrate the instrument in accordance with the manufacturer=s specifications.
2. Collect the sample and check and record its temperature.
3. Correct the conductivity instruments temperature adjustment to the temperature of the sample (if required).
4. Immerse the probe in the sample keeping it away from the sides and bottom of the container. It is important that the entire portion of the probe be wetted by the sample. This will be evident when some of the sample water is seen coming out of the small weep hole.
5. Record the result in the field log book or field sampling sheet. Units of conductivity are micro ohms **per centimeter ($\mu\text{ohms/cm}$) at 25°C**. Results should be reported to the nearest 10 units for readings below 1,000 $\mu\text{ohms/cm}$ and to the nearest 100 units for readings above 1,000 $\mu\text{ohms/cm}$.
6. Rinse probe.

3.4 Dissolved Oxygen

Dissolved oxygen (DO) should be measured in-situ or adown hole@ whenever possible. If in-situ measurements are not possible, precautions should be taken to minimize the time the sample is exposed to ambient air. Dissolved oxygen readings should not exceed the saturation limit of oxygen in water (8 to 10 mg/l). If readings greater than 10mg/l are observed, the meter is probably not functioning correctly. The procedures for collecting a DO sample are as follows:

1. Inspect the membrane of the DO meter for air bubbles and/or holes. If air bubbles or holes exist, replace the membrane.
2. Calibrate the DO meter in accordance with the manufacturer=s specifications.



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3. Measure the temperature of the sample and adjust the temperature setting of the DO meter, if so equipped.
4. Record the reading in the field log book or field sampling sheet. Dissolved oxygen is measured in units of mg/l. Results should be reported to the nearest tenth of a unit (0.1).

3.5 Turbidity

Turbidity is measured using a nephelometer/turbidimeter. The procedures for measuring turbidity are as follows:

1. Rinse the sample cell with analyte-free water.
2. Follow the manufacturer=s specifications for collecting a turbidity measurement.
3. Record the reading in the field log book or field sampling sheet. The units of turbidity are nephelometric turbidity units or NTUs. Units should be recorded to the nearest whole unit.

4.0 CAUTIONS AND INTERFERENCES

Refer to owner=s manual for instructions on proper calibration methods of all field parameter measuring equipment.



STANDARD OPERATING PROCEDURE NO. 7.8 GROUNDWATER SAMPLING USING A LOW-FLOW TECHNIQUES

SOP#: 7.8
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1.0 METHOD SUMMARY

Most hazardous waste site investigations utilize some form of a groundwater sampling or monitoring program to fully characterize the nature and extent of groundwater contamination. In order to obtain a representative groundwater sample for chemical analysis it is important to remove stagnant water in the borehole or pump tubing before collection of the sample. This may be achieved using a variety of instruments including pumps and bailers. Once purging is completed and the correct laboratory-cleaned sample containers have been prepared, sampling may proceed. Sampling may be conducted with any of the above instruments, and need not be the same as the device used for purging. During sampling, a field data sheet should be completed, a chain of custody form prepared, and all pertinent data recorded in the site logbook. This SOP describes the procedures for sampling a monitoring well using low-flow techniques. Low-flow methods are typically used in conjunction with micropurging (See SOP 7.4).

2.0 EQUIPMENT/APPARATUS/REAGENTS

The following is a typical equipment list used for sampling groundwater monitoring wells using a pump.

- Field data sheets and sample jar labels
- Chain-of-custody forms/Custody seals
- Sample containers
- Knife or scissors
- 5-gallon buckets
- Plastic sheeting
- Shipping containers
- Packing materials
- Ziploc-type plastic bags
- Field parameter instruments (pH meter, thermometer, conductivity meter, turbidimeter, DO meter)
- Calibration standards
- Non-phosphate soap (Note: Alconox is not considered a non-phosphate soap; rather a low-phosphate soap)
- Generator, if using pump
- Air compressor for bladder pumps
- Pump
- Gasoline for generator
- Discharge tubing for pump
- Control box (if necessary)
- Appropriate pump fittings (e.g., hose clamps, barbed fittings, etc.)
- Appropriate PPE

3.0 PROCEDURES

This section outlines the procedures for collecting representative groundwater samples using the following steps: Each step in the procedure is covered in a separate SOP. The reference SOP is in parenthesis.

Low-flow sampling procedures should be used whenever pumps are used for groundwater sampling. These procedures should be used in conjunction with micropurging techniques.

1. Prepare for sampling using: SOP 6.1 (Documentation), 6.3 (Collection of VOCs), 6.4 (Sample Handling and Control), and 6.5 (Collection of QC Samples).
2. Water level/sediment measurements will be taken in accordance with SOP 7.1 (Water Level Measurement)



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3. Measurement of field parameters will be done in accordance with SOP 7.5 (Measurements of Monitoring Well Field Parameters).
4. Purging will be done in accordance with SOP 7.4 (Micro Purging).
5. Allow well to recharge after purging to 90% of the static water level.
6. Disconnect flow-through cells.
7. Assemble and label the appropriate bottles.
8. Set the pump height so that the intake is near the center of the screened interval.
9. Adjust the flow rate of the pump to minimize aeration and bubble formation. A flow rate of <0.5 L/min is typically appropriate. The pump discharge should produce a thin, continuous stream of water when filling the sample container.
10. Begin using the pump to fill the appropriate container. Samples should be collected in the following order:
 - Volatile organic compounds (VOCs)
 - Semi-volatile organic compounds (SVOCs); including polyaromatic hydrocarbons (PAHs)
 - Inorganic constituents (metals)
 - Mercury
 - Cyanide
 - Total organic carbon (TOC)
 - Total organic halogen (TOX)
 - Samples requiring field filtration
 - Samples for field parameter measurement
 - Samples for nutrient anion determinations
11. Filter and preserve samples as required by sampling plan.
12. Cap the sample container tightly and place pre-labeled sample container in a pre-chilled cooler.
13. Replace the well cap.
14. Log all samples in the site logbook and on the chain-of-custody form and label all samples in accordance with SOP 6.1 (Documentation).
15. Package samples and complete necessary paperwork in accordance with SOP 6.4 (Sample Handling and Control).
16. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

4.0 CAUTIONS AND INTERFERENCES

Before sampling, monitoring wells shall be allowed to stabilize for a minimum period of 24 hours after development.

The primary goal in performing groundwater sampling is to obtain a representative sample of the groundwater body. Analysis can be compromised by field personnel in two primary ways: (1) taking an



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unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel. While laboratory methods have become extremely sensitive, well controlled and quality assured, they cannot compensate for a poorly collected sample. The collection of a sample should be as sensitive, highly developed and quality assured as the analytical procedures.

Sample withdrawal methods require the use of pumps, compressed air, bailers, and samplers. Ideally, sample withdrawal equipment should be completely inert, economical to manufacture, easily cleaned, sterilized, reusable, able to operate at remote sites in the absence of power sources, and capable of delivering variable rates for sample collection. Wells should be sampled as soon as possible after purging (certainly no more than 24 hours) and should be sampled in order from least contaminated to most contaminated or from upgradient to downgradient if chemistry is unknown. Water levels shall be allowed to recover to 90% of the static water level before sampling. All non-dedicated equipment shall be decontaminated in accordance with SOP 1.5 (Decontamination) prior to use or upon completion of the sampling activities.



STANDARD OPERATING PROCEDURE NO. 10.2 SOIL SAMPLING USING A SPLIT BARREL SAMPLER

SOP#: 10.2
DATE: 12/3/2001
REVISION #: 1
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1.0 METHOD SUMMARY

Subsurface sampling attempts to remove soil below the ground surface in a relatively undisturbed state in order to quantify the extent of contamination at specific depths. Soil samples shall be collected based on odors, discoloration, organic vapor meter readings, predetermined depth, and any other appropriate field screening method.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The contractor shall describe the equipment to be used to collect the sample, field screening equipment including calibration and quality control (QC) requirements for the samples to be taken. Each instrument will be calibrated according to the manufacturer's operating manual prior to each day's use. Instrument calibrations will be documented in the field book. During this calibration, an appropriate maintenance check will be performed on each piece of equipment. If damaged or failed parts are identified during the daily maintenance check and it is determined that the damage can impact the instrument's performance, the instrument will be removed from service until the part or parts are replaced or repaired. An equivalent piece of equipment will be substituted for the malfunctioning instrument to maintain schedule, if possible. Typical equipment required for subsurface sampling includes:

- Tape measure (in tenths of feet)
- Split-barrel samplers
- Knife
- Field logbook
- Waterproof and permanent marking pens
- Duct tape
- Decontamination supplies
- Paper towels
- Appropriate personal protective equipment (PPE)
- Sample jars with labels
- Cooler with ice
- Zip-lock bags
- Drum for drill cuttings, if necessary
- Organic Vapor Meter
- Table for examining drilled cores

3.0 PROCEDURES

When soil samples are to be submitted for laboratory analysis, they shall be collected using stainless steel, continuous drive, California modified split-barrel sampler, or equivalent. These samplers are 24 inches in length and have an outside diameter (OD) of 2 inches to accommodate four 2-inch diameter brass/stainless steel rings, each of which is 6 inches in length. The brass/stainless steel rings are optional and are used only when collecting geotechnical samples.

Each time a split-barrel sample is taken, a standard penetration test shall be performed in accordance with ASTM C-1586 Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

1. Decontaminate the split barrel sampler to be used for soil sampling.
2. Soil sampling using a split barrel soil sampling is performed in conjunction with SOP 5.1 (Hollow Stem Borehole Advancement) or 5.3 (Mud Rotary Borehole Advancement).
3. Attach the split barrel sampler to the center rods and lower the sampler to the bottom of the bore hole.
4. Attach the drill rig drive hammer to the center rods.



STANDARD OPERATING PROCEDURE NO. 10.2 SOIL SAMPLING USING A SPLIT BARREL SAMPLER

SOP#: 10.2
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5. Drive the sampler a depth of 1 foot into undisturbed soil with a 140-pound hammer free falling a distance of 30 inches.
6. Drive 6 inches to seat it in undisturbed soil; then perform test.
7. For each 6 inches of penetration, record the number of hammer blows for seating the spoon and making the test (i.e., 5/7/8).
8. Obtain the standard penetration test result (N) by adding the last two figures (i.e., 7+8=15 blows per foot).
9. Drive the sampler an additional 6 inches to fill the remainder of the split-spoon prior to retrieval, if necessary.
10. Detach the hammer and attach the center rods to the hanger assembly.
11. Pull the split-barrel sampler out of the bore hole and detach the sampler from the center rods.
12. Disassemble the sampler.
13. As soon as the split-spoon is opened, monitor the open ends of the brass/stainless steel rings for organic vapors using the PID or FID.
14. Record the results on the boring log and in the field log book.

Samples for VOC analysis will be collected following the sample collection procedures discussed in TCEQ Superfund Program SOP No. 6.3.

If initial screening results indicate the presence of organic vapors, a headspace analysis shall be conducted on remaining portions of the sample.

Grab samples shall be collected by obtaining a representative volume of soil from the area to be sampled and placing it directly into the sample bottle.

Collection of QC samples shall be done in accordance with SOP 6.5 (Collection of QC Samples).

The sampling equipment shall be decontaminated in accordance with SOP 1.5 (Decontamination) between each sample, and new gloves should be worn each time.

4.0 CAUTIONS AND INTERFERENCES

Rock or impenetrable soil may be encountered during split spoon sampling. If this is the case, a different method may be used (drill rig, etc), or it may be necessary to move to another location. If access is a problem, different drilling methods or locations may solve this problem as well.



STANDARD OPERATING PROCEDURE NO. 10.4 SOIL SAMPLING USING DIRECT PUSH

SOP#: 10.4
DATE: 12/3/2001
REVISION #: 1
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1.0 METHOD SUMMARY

Subsurface sampling attempts to remove soil below the ground surface in a relatively undisturbed state in order to quantify the extent of contamination at specific depths. Soil samples shall be collected based on odors, discoloration, organic vapor meter readings, predetermined depth, and any other appropriate field screening method. This SOP does not describe the procedures for operating a Geoprobe™ or similar direct push unit.

2.0 EQUIPMENT/APPARATUS/REAGENTS

The contractor shall describe the equipment to be used to collect the sample, field screening equipment including calibration and quality control (QC) requirements for the samples to be taken. Each instrument will be calibrated according to the manufacturer's operating manual prior to each day's use. Instrument calibrations will be documented in the field book. During this calibration, an appropriate maintenance check will be performed on each piece of equipment. If damaged or failed parts are identified during the daily maintenance check and it is determined that the damage can impact the instrument's performance, the instrument will be removed from service until the part or parts are replaced or repaired. An equivalent piece of equipment will be substituted for the malfunctioning instrument to maintain schedule, if possible. Typical equipment required for subsurface sampling includes:

- Tape measure (in tenths of feet)
- Utility Knife
- Field logbook
- Waterproof and permanent marking pens
- Duct tape
- Latex gloves
- Decontamination supplies
- Paper towels
- Appropriate personal protective equipment (PPE)
- Sample jars with labels
- Cooler with ice
- Zip-lock bags
- Table for examining drilled cores
- Field screening equipment

3.0 PROCEDURES

Direct push sampling involves advancing a sampling probe by applying direct hydraulic pressure by using a slide or rotary hammer. Samples may be collected continuously or at specific depths. Typically a subcontractor is used to perform the actual probing operation. To collect samples using push methods:

1. Once the sampler is removed from the hole, the soil sample is recovered by unscrewing the cutting shoe and pulling the liner out. When the shoe is loosened, pull the liner from the sample tube.
2. Carefully cut the liner open, using a utility knife with a hooked blade (linoleum blade). By cutting the sample liner along two sides the sample can be exposed.
3. Describe the sample lithology and record on the boring log.
4. Monitor head space readings (if necessary).
5. Fill the appropriate sample jars using the material from the open sample liner.
6. Collect VOC samples in accordance with SOP 6.3 (Collection of VOCs).



STANDARD OPERATING PROCEDURE NO. 10.4 SOIL SAMPLING USING DIRECT PUSH

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7. Collect QC samples in accordance with SOP 6.5 (Collection of QC Samples).
8. Tighten the caps securely on the sample jars.
9. Place samples in a cooler with ice and fill out the chain of custody in accordance SOP 6.4 (Sample Handling and Control).
10. Record the appropriate information in the field logbook in accordance with SOP 6.1 (Documentation).
11. Decontaminate all non-disposable sampling equipment in accordance with SOP 1.5 (Decontamination).

4.0 CAUTIONS AND INTERFERENCES

Rock or impenetrable soil may be encountered during the direct push method. If this is the case, it may be necessary to move to another location.



STANDARD OPERATING PROCEDURE NO. 17.1

GLOBAL POSITIONING SYSTEM DATA

COLLECTION AND SUBMISSION

SOP#: 17.1
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1.0 METHOD SUMMARY

TCEQ requires the use of Global Positional System (GPS) in conjunction with other technologies to collect and maintain positional data that provides physical and environmental site information about plume and contaminate changes over time. Also GPS technologies are used to provide the boundaries of buildings, real property, waste areas, locations of wells and other relevant site features.

2.0 GPS CERTIFICATION

To ensure that TCEQ receives reliable and accurate positional data, TCEQ OPP 8.12 requires that the GPS data collector must be certified. The TCEQ staff may obtain GPS certification by attending a training course presented by either an internal GPS trainer or by a manufacturer-certified GPS trainer. Non-TCEQ staff may obtain GPS certification from a manufacturer-certified GPS trainer. All GPS data collectors must verify that the certification instruction they have received meets the minimum elements listed in Table 1 - GPS Certified Training Minimum Elements in the Third Party GPS Training Certification section of this SOP.

3.0 EQUIPMENT/APPARATUS

- A DGPS (Differential Global Positioning System) receiver can be either a stand alone unit, or a GPS module with Differential GPS antenna and relevant satellite subscription, plugged into a portable computer. The DGPS receiver must:
 - Have six channel parallel reception or better.
 - Have sub-meter horizontal accuracy.
 - Employ these processing parameters:
 - Position acquisition rate - 1/second or better
 - Position mode - 3D (uses 4 satellites)
 - Maximum PDOP - 6(or less)
 - Minimum Elevation - User-Selectable (record elevation accuracy)
- Have the ability to perform real-time differential correction (no post processing).
- Receive correction data from a recognized, reliable source, and which is appropriate for real-time correction in the geographic area in which the GPS measurements will be made.
- Output correction data in RTCM-SC104 (Radio Technical Commission of Maritime Service - Special Committee Paper No.104) format via an RS-232 cable_or other compatible connection which matches the DGPS receiver.
- Have ability to store at least 180 position measurements.
- Have ability to transfer almanac and position data to a personal computer via a serial port or USB connection.
- Include software to perform mission planning, differential correction, point data averaging, and conversion to common formats (Grid or ArcView).
- Have a water and shock resistant case.
- Include portable power source(s) which will last a full working day.



STANDARD OPERATING PROCEDURE NO. 17.1 GLOBAL POSITIONING SYSTEM DATA COLLECTION AND SUBMISSION

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- All weather proof Field Log Book.
- A laser rangefinder (optional)

4.0 GPS DATA COLLECTION AND ACCURACY

Horizontal Accuracy - All horizontal positions collected using certified GPS units shall maintain sub-meter accuracy. In order to meet sub-meter accuracy, latitude and longitude coordinates should be carried out to at least 6 places for decimal degree and at least 2 place for decimal seconds.

DGPS - Differential Global Positioning System (DGPS) receiver which corrects the atmospheric effects. DGPS are used for realtime GPS mapping and tracking without the need for post-processing.

PDOP - Positional Dilution of Precision. A measure of the quality of a GPS measurement taken from a given set of four satellites at a given time. If the satellites are not widely distributed from the user's location, the PDOP value will be higher, and the quality of the measurement will be diminished. PDOP values greater than 6 are not acceptable.

Datum - A mathematical model used by cartographers to define the shape of the earth in a specific area. Always use North America Datum of 1983 (NAD 83).

Differential Correction - A process applied to raw GPS data that removes certain types of errors; primarily, the error introduced by Selective Availability. This process requires correction data from a reference GPS receiver operating from a precisely known location. Correction data must be obtained from a recognized, reliable source (such as the reference network maintained by the Texas Department of Transportation) or Racal LandStar, and certain Trimble units, provide a satellite delivered GPS correction service, which provide 24 hour accurate and reliable real time precise positioning on land and in the air. For full coverage in Texas, the differential signal is transmitted to the user by high-power geostationary satellites. The GPS and differential signal are both received by the GPS via a single antenna.

A single position reading obtained through appropriate use of real-time correction must have sub-meter accuracy.

Collection Methods - GPS data may be collected using one of three methods:

- **Superimposed** - The superimposed method involves standing on top of or next to the subject for which you are collecting GPS locational data. Collect 60-100 readings.
- **Centroid** - The centroid method is used when the superimposed method cannot be used (e.g. well inside a locked fence or structure). Take points equal distance from the desired point by starting and stopping the GPS and by averaging these points. The unit will average the point for each reading and then all the points as one point which will be the center of all the readings. Collect a minimum of 30 readings per point prior to averaging.



STANDARD OPERATING PROCEDURE NO. 17.1 GLOBAL POSITIONING SYSTEM DATA COLLECTION AND SUBMISSION

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- Offset - The offset method is used when the superimposed method cannot be used and only when accurate offset measurements can be made (e.g. Using a laser rangefinder, tape measure, etc.) The potential error associated with the offset measurement must be added to the potential error associated with the GPS measurement. A note in the GPS logging software and the field log book of bearing and distance from the offset location can be used but location must be corrected before it is entered into a table or shape file.
- Points - The point is used for well and sample locations, gates, sub-meter objects, etc.
- Line - The line is used for trail, road, stream, berm, etc.
- Polygon - The polygon is used for buildings, site boundary, waste area, ponds or piles, etc. If it is hard to walk the entire perimeter, readings can be taken at each corner of the polygon by starting and stopping the GPS at the corners and within the same Station. The program will add the line in between the points of the Station to create a polygon.

5.0 DATA SUBMITTALS

Correction Status - All GPS data submitted must have a field indicating each record's differential correction status. There are only two selections available:

- Differential Correction - Indicates that the record has been differentially corrected.
- Uncorrected - Indicates that the record has not been differentially corrected.

Offset - The offset points must be noted in the field log book and actual points calculated before entering the station into the final database or shape file.

Events - Each event must be in separate data table or shape file.

Data Sets - Each data set must be in separate file or layer (e.g All wells, buildings, site boundaries, sample results/event, site features, roads, trails, utilities, etc. must be in separate layers/tables).
Arc View files - All data must be in Decimal Degrees, NAD 83 exported to Arc View 3.2 as a shape files with the relevant metadata, a hard copy of the Arc View tables must accompany the electronic version for TCEQ submittal.

Field Log Book - Site name location and details of field activity must be noted in the field log book, including the name and coordinates of each station and bearing and distance details describing any station off-sets.

Minimum Attributes - All GPS data submitted to TCEQ should conform to the data attributes defined in Table 1.



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Table 1
GPS Data Attributes

Attribute	Data Type	Field Length	Description
Latitude	Number	Double	Decimal Degree to a minimum of six decimal places
Longitude	Number	Double	Decimal Degree to a minimum of six decimal places
Site Name	Text	50	Superfund Site Name
Station Name	Text	50	Monitoring well number or Sample name
Station Reference / Comments	Text	50	Station Location Relative to Facility
Station Type	Text	10	Point, Line or Polygon
Collector Name	Text	50	Last Name, First Initial
GPS Certificate Number	Text	8	TCEQ GPS Certificate Number
Collection Method	Text	15	Superimposed, Centroid, Offset
Datum	Text	5	Horizontal Datum (NAD27, NAD83 or WGS84)
Max PDOP	Number	Single	Maximum PDOP value in effect during data collection (not > 6)
Receiver Type	Text	50	GPS model name & accuracy
Correction Status*	Text	50	Tells whether or not GPS data was differentially corrected
GPS Date	Date	N/A	Date GPS data was collected
GPS Time	Text	8	Time GPS data was collected
Total Positions Collected	Number	Integer	Number of positions collected/corrected
* Data that is not differentially corrected will be rejected.			



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Data Format - GPS data submitted to TCEQ should be in electronic format (dBASE IV, .dbf file format is preferred). The following is an example of how the data table should be structured. The data may be submitted via email, on diskette, or CD.

Table 2														
Third Party GPS Data														
Example Data Table														
Latitude	Longitude	Site Name	Station Name	Station Reference/ Comments	Collector Name	TCEQ GPS Certificate Number	Datum	Collection Method	Max PDP	Receiver Type	Correction Status	GPS Date	GPS Time	Total Positions
11.111000	99.999000	Pioneer	MW-21	NW Corner	Terry, D	95081107	NAD83	Superimposed	4.4	Trimble XRS DGPS	Differential Correction	5/22/00	10:10 AM	61
11.111100	99.999100	Pioneer	MW-22	Center of the facility	Terry, D	95081107	NAD83	Centroid	5.2	Trimble XRS DGPS	Differential Correction	5/22/00	10:25 AM	108
11.111200	99.999200	Pioneer	MW-23	S of entrance	Terry, D.	95081107	NAD83	Superimposed	3.5	Trimble XRS DGPS	Differential Correction	5/22/00	1:38 PM	66
11.111200	99.999200	Pioneer	site location	South Entrance of facility	Terry, D.	95081107	NAD83	Superimposed	3.5	Trimble XRS DGPS	Differential Correction	5/22/00	3:38 PM	60



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Third Party GPS Training Certification
Minimum Qualifications
Texas Natural Resource Conservation Commission

TCEQ OPP 8.12 requires all GPS training courses to include both lecture/classroom discussion and hands-on exercises. Table 1 contains the minimum elements that must be included in any TCEQ-recognized GPS certification training course

Table 1 GPS Certification Training Minimum Elements	
Minimum lecture and/or demonstration elements	Minimum hands-on exercises, to be successfully completed by each student
<ul style="list-style-type: none">Q Background of the Global Positioning System.Q GPS accuracy issues.Q Relevant Agency operating policies.Q Operation of GPS equipment, including basic troubleshooting.Q Data collection procedures.Q Differential correction, both real time processing and post processing.Q Coordinate averaging for point locations.Q Data output in formats appropriate for import to GIS or tabular databases.	<ul style="list-style-type: none">Q Pre-planning, including data quality objectives, equipment and materials needed, logistics of field data collection, and prediction of GPS data collection conditions.Q Navigation to a given coordinate.Q Storing and transferring raw positional data.Q Differential correction of raw data through post processing.Q Averaging corrected point data and outputting to a GIS file.
Class exercises shall also include computer plotting of point data to allow students to better understand GPS accuracy issues and the effects of differential correction and point data averaging.	
Note: All certified GPS users recognized by TCEQ must be recertified every 2 years; \$ Sales or user demonstrations do NOT constitute GPS training; \$ GPS training courses should last a minimum of six to eight hours; \$ The TCEQ GPS operating policy is available online at: http://www.tceq.state.tx.us/gis/gisplcy.html	



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Individuals obtaining or with current GPS certification training must verify that the instruction they have received meets the minimum elements listed in Table 1. Therefore, fill out the attached form, along with copies of GPS training certificates, and return them to:

David P. Terry
TCEQ GPS Coordinator (MCC-155)
SWAP Team
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087
(512) 239 4755
Email: dterry@tceq.state.tx.us



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**GPS Certification Verification Form
Texas Commission on Environmental Quality**

Contact Information				
GPS Training Coordinator Information			Training Provider Information	
Name			Organization Providing GPS Training	
Organization			Instructor	
Mailing Address			Course Name	
City	State	ZIP	Course Date	Course Hours
Email Address			GPS System (e.g. Trimble, Magellan, etc.)	Manufacture
				Yes 9 No 9

The following individual(s) have received GPS certification training that complies with TCEQ OPP 8.12 minimum training elements:

Name	Title

I hereby state that the information provided is true, accurate, and complete to the best of my abilities

Signature of GPS Training Coordinator or GPS Trainer	Title	Date
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Printed Name	Telephone Number	Extension
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Appendix B: Laboratory NELAP Accreditation Certificate

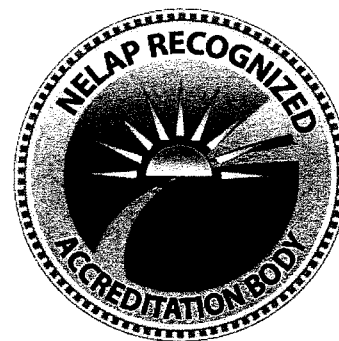
This appendix contains an excerpt from the Accutest Laboratory Gulf Coast, Inc NELAP certificate. The excerpt contains:

- PDF Page 1 the certificate number T104704220-14-15 which expires March 31, 2015
- PDF Page 2 lists the analytes in non-potable water analyzed by SW-846 EPA Method 1010 for ignitability and SW-846 EPA 1311 for the Toxicity Leaching Characteristic Procedure.
- PDF Page 12 lists the analytes in non-potable water analyzed by SW-846 EPA Method 6020 for metals.
- PDF Pages 20-28 lists the analytes in non-potable water analyzed by SW-846 EPA Method 8260 for VOCs, SW-846 EPA Method 8270 for SVOCs, and SW-846 EPA Method 9040 for pH analysis.
- PDF Page 32 lists the analytes in non-potable water analyzed by TCEQ Method 1005 for total petroleum hydrocarbons.
- PDF Page 33 lists the analytes in solid/chemical matrixes (soils) analyzed by SW-846 EPA Method 1010 for ignitability and SW-846 EPA 1311 for the Toxicity Leaching Characteristic Procedure.
- PDF Pages 34-35 lists the analytes in solid/chemical matrixes (soils) analyzed by SW-846 EPA Method 6020 for metals.
- PDF Pages 38-46 lists the analytes in solid/chemical matrixes (soils) analyzed by SW-846 EPA Method 8260 for VOCs, SW-846 EPA Method 8270 for SVOCs, SW-846 EPA Method 9040 for pH and corrosivity, and SW-9045 for pH and corrosivity analysis.
- PDF Page 48 lists the analytes in soil analyzed by TCEQ Method 1005 for total petroleum hydrocarbons.



Texas Commission on Environmental Quality

NELAP-Recognized Laboratory Accreditation is hereby awarded to



Accutest Laboratories Gulf Coast, Inc.

10165 Harwin Drive, Suite 150
Houston, TX 77036-1622

in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25, and the National Environmental Laboratory Accreditation Program.

The laboratory's scope of accreditation includes the fields of accreditation that accompany this certificate. Continued accreditation depends upon successful ongoing participation in the program. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current location(s) and accreditation status for particular methods and analyses (www.tceq.texas.gov/goto/lab). Accreditation does not imply that a product, process, system or person is approved by the Texas Commission on Environmental Quality.

Certificate Number: T104704220-14-15

Effective Date: 4/9/2014

Expiration Date: 3/31/2015

A handwritten signature in black ink, appearing to read "R. A. Hylb", written over a horizontal line.

**Executive Director Texas Commission on
Environmental Quality**



Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation



Accutest Laboratories Gulf Coast, Inc.

10165 Harwin Drive, Suite 150
Houston, TX 77036-1622

Certificate: T104704220-14-15
Expiration Date: 3/31/2015
Issue Date: 4/9/2014

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

Method ASTM D6503

Analyte	AB	Analyte ID	Method ID
Enterococci	TX	2520	30032407

Method EPA 1010

Analyte	AB	Analyte ID	Method ID
Ignitability	TX	1780	10116606

Method EPA 120.1

Analyte	AB	Analyte ID	Method ID
Conductivity	TX	1610	10006403

Method EPA 1311

Analyte	AB	Analyte ID	Method ID
TCLP	TX	849	10118806

Method EPA 1312

Analyte	AB	Analyte ID	Method ID
SPLP	TX	850	10119003

Method EPA 160.4

Analyte	AB	Analyte ID	Method ID
Residue-volatile	TX	1970	10010409

Method EPA 1664

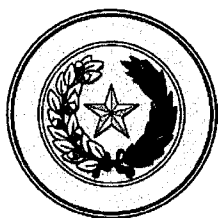
Analyte	AB	Analyte ID	Method ID
n-Hexane Extractable Material (HEM) (O&G)	TX	1803	10127807

Method EPA 180.1

Analyte	AB	Analyte ID	Method ID
Turbidity	TX	2055	10011606

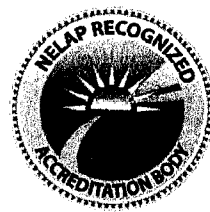
Method EPA 200.7

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10013806
Antimony	TX	1005	10013806
Arsenic	TX	1010	10013806
Barium	TX	1015	10013806
Beryllium	TX	1020	10013806



Texas Commission on Environmental Quality

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Expiration Date: 3/31/2015
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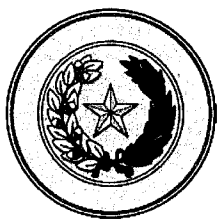
Matrix: *Non-Potable Water*

Method EPA 6020

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10156408
Antimony	TX	1005	10156408
Arsenic	TX	1010	10156408
Barium	TX	1015	10156408
Beryllium	TX	1020	10156408
Cadmium	TX	1030	10156408
Calcium	TX	1035	10156408
Chromium	TX	1040	10156408
Cobalt	TX	1050	10156408
Copper	TX	1055	10156408
Iron	TX	1070	10156408
Lead	TX	1075	10156408
Magnesium	TX	1085	10156408
Manganese	TX	1090	10156408
Molybdenum	TX	1100	10156408
Nickel	TX	1105	10156408
Potassium	TX	1125	10156408
Selenium	TX	1140	10156408
Silver	TX	1150	10156408
Sodium	TX	1155	10156408
Thallium	TX	1165	10156408
Titanium	TX	1180	10156408
Vanadium	TX	1185	10156408
Zinc	TX	1190	10156408

Method EPA 608

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	TX	7355	10103603
4,4'-DDE	TX	7360	10103603
4,4'-DDT	TX	7365	10103603



Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation



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10165 Harwin Drive, Suite 150
Houston, TX 77036-1622

Certificate:

T104704220-14-15

Expiration Date:

3/31/2015

Issue Date:

4/9/2014

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

2,4-D	TX	8545	10183207
2,4-DB	TX	8560	10183207
4-Nitrophenol	TX	6500	10183207
Chloramben	TX	8540	10183207
Dalapon	TX	8555	10183207
Dicamba	TX	8595	10183207
Dichloroprop (Dichlorprop, Weedone)	TX	8605	10183207
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	TX	8620	10183207
MCPA	TX	7775	10183207
MCPP	TX	7780	10183207
Pentachlorophenol	TX	6605	10183207
Picloram	TX	8645	10183207
Silvex (2,4,5-TP)	TX	8650	10183207

Method EPA 8260

Analyte	AB	Analyte ID	Method ID
1,1,1,2-Tetrachloroethane	TX	5105	10184802
1,1,1-Trichloroethane	TX	5160	10184802
1,1,2,2-Tetrachloroethane	TX	5110	10184802
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	TX	5195	10184404
1,1,2-Trichloroethane	TX	5165	10184802
1,1-Dichloroethane	TX	4630	10184802
1,1-Dichloroethylene	TX	4640	10184802
1,1-Dichloropropene	TX	4670	10184802
1,2,3-Trichlorobenzene	TX	5150	10184802
1,2,3-Trichloropropane	TX	5180	10184802
1,2,4-Trichlorobenzene	TX	5155	10184802
1,2,4-Trimethylbenzene	TX	5210	10184802
1,2-Dibromo-3-chloropropane (DBCP)	TX	4570	10184802
1,2-Dibromoethane (EDB, Ethylene dibromide)	TX	4585	10184802
1,2-Dichlorobenzene	TX	4610	10184802



Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation



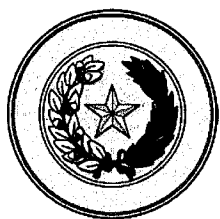
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Issue Date: 4/9/2014

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Matrix: Non-Potable Water

1,2-Dichloroethane (Ethylene dichloride)	TX	4635	10184802
1,2-Dichloropropane	TX	4655	10184802
1,3,5-Trimethylbenzene	TX	5215	10184802
1,3-Dichlorobenzene	TX	4615	10184802
1,3-Dichloropropane	TX	4660	10184802
1,4-Dichlorobenzene	TX	4620	10184802
1,4-Dioxane (1,4-Diethyleneoxide)	TX	4735	10184802
1-Chlorohexane	TX	4510	10184802
2,2-Dichloropropane	TX	4665	10184802
2-Butanone (Methyl ethyl ketone, MEK)	TX	4410	10184802
2-Chloroethyl vinyl ether	TX	4500	10184802
2-Chlorotoluene	TX	4535	10184802
2-Hexanone (MBK)	TX	4860	10184802
2-Nitropropane	TX	5020	10184802
4-Chlorotoluene	TX	4540	10184802
4-Isopropyltoluene (p-Cymene)	TX	4915	10184802
4-Methyl-2-pentanone (MIBK)	TX	4995	10184802
Acetone (2-Propanone)	TX	4315	10184802
Acetonitrile	TX	4320	10184802
Acrolein (Propenal)	TX	4325	10184802
Acrylonitrile	TX	4340	10184802
Allyl chloride (3-Chloropropene)	TX	4355	10184404
Benzene	TX	4375	10184802
Benzyl chloride	TX	5635	10184802
Bromobenzene	TX	4385	10184802
Bromochloromethane	TX	4390	10184802
Bromodichloromethane	TX	4395	10184802
Bromoform	TX	4400	10184802
Carbon disulfide	TX	4450	10184802
Carbon tetrachloride	TX	4455	10184802



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Matrix: *Non-Potable Water*

Chlorobenzene	TX	4475	10184802
Chlorodibromomethane	TX	4575	10184802
Chloroethane (Ethyl chloride)	TX	4485	10184802
Chloroform	TX	4505	10184802
Chloroprene (2-Chloro-1,3-butadiene)	TX	4525	10184802
cis-1,2-Dichloroethylene	TX	4645	10184802
cis-1,3-Dichloropropene	TX	4680	10184802
Crotonaldehyde	TX	4545	10184802
Dibromochloropropane	TX	4580	10184802
Dibromomethane (Methylene bromide)	TX	4595	10184802
Dichlorodifluoromethane (Freon-12)	TX	4625	10184802
Diethyl ether	TX	4725	10184802
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	TX	4745	10184802
Ethanol	TX	4750	10184802
Ethyl acetate	TX	4755	10184802
Ethyl methacrylate	TX	4810	10184608
Ethylbenzene	TX	4765	10184802
Ethylene oxide	TX	4795	10184802
Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	TX	4770	10184608
Hexachlorobutadiene	TX	4835	10184802
Hexachloroethane	TX	4840	10184404
Iodomethane (Methyl iodide)	TX	4870	10184802
Isobutyl alcohol (2-Methyl-1-propanol)	TX	4875	10184608
Isopropyl ether	TX	4905	10184404
Isopropylbenzene (Cumene)	TX	4900	10184802
m+p-xylene	TX	5240	10184802
Methacrylonitrile	TX	4925	10184404
Methyl acetate	TX	4940	10184404
Methyl bromide (Bromomethane)	TX	4950	10184802
Methyl chloride (Chloromethane)	TX	4960	10184802



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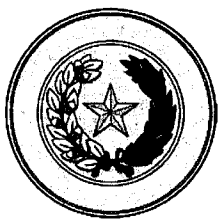
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Matrix: *Non-Potable Water*

Methyl methacrylate	TX	4990	10184404
Methyl tert-butyl ether (MTBE)	TX	5000	10184802
Methylcyclohexane	TX	4965	10184608
Methylene chloride (Dichloromethane)	TX	4975	10184802
Naphthalene	TX	5005	10184802
n-Butyl alcohol (1-Butanol, n-Butanol)	TX	4425	10184608
n-Butylbenzene	TX	4435	10184802
n-Propylbenzene	TX	5090	10184802
o-Xylene	TX	5250	10184802
Pentachloroethane	TX	5035	10184802
Propionitrile (Ethyl cyanide)	TX	5080	10184802
sec-Butylbenzene	TX	4440	10184802
Styrene	TX	5100	10184802
T-amylmethylether (TAME)	TX	4370	10184802
tert-Butyl alcohol	TX	4420	10184802
tert-Butylbenzene	TX	4445	10184802
Tetrachloroethylene (Perchloroethylene)	TX	5115	10184802
Toluene	TX	5140	10184802
trans-1,2-Dichloroethylene	TX	4700	10184802
trans-1,3-Dichloropropylene	TX	4685	10184802
trans-1,4-Dichloro-2-butene	TX	4605	10184802
Trichloroethene (Trichloroethylene)	TX	5170	10184802
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	TX	5175	10184802
Vinyl acetate	TX	5225	10184802
Vinyl chloride	TX	5235	10184802
Xylene (total)	TX	5260	10184802

Method EPA 8270

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	TX	6715	10185805
1,2,4-Trichlorobenzene	TX	5155	10185805



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Matrix: *Non-Potable Water*

1,2-Dichlorobenzene	TX	4610	10185805
1,2-Diphenylhydrazine	TX	6220	10185805
1,3,5-Trinitrobenzene (1,3,5-TNB)	TX	6885	10185407
1,3-Dichlorobenzene	TX	4615	10185805
1,3-Dinitrobenzene (1,3-DNB)	TX	6160	10185407
1,4-Dichlorobenzene	TX	4620	10185805
1,4-Naphthoquinone	TX	6420	10185407
1,4-Phenylenediamine	TX	6630	10185601
1-Chloronaphthalene	TX	5790	10185805
1-Naphthylamine	TX	6425	10186002
2,3,4,6-Tetrachlorophenol	TX	6735	10185805
2,4,5-Trichlorophenol	TX	6835	10185805
2,4,5-Trimethylaniline	TX	6880	10185805
2,4,6-Trichlorophenol	TX	6840	10185805
2,4-Diaminotoluene	TX	5880	10185203
2,4-Dichlorophenol	TX	6000	10185805
2,4-Dimethylphenol	TX	6130	10185805
2,4-Dinitrophenol	TX	6175	10185805
2,4-Dinitrotoluene (2,4-DNT)	TX	6185	10185805
2,6-Dichlorophenol	TX	6005	10185805
2,6-Dinitrotoluene (2,6-DNT)	TX	6190	10185805
2-Acetylaminofluorene	TX	5515	10185805
2-Chloronaphthalene	TX	5795	10185805
2-Chlorophenol	TX	5800	10185805
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	TX	6360	10185805
2-Methylaniline (o-Toluidine)	TX	5145	10185805
2-Methylnaphthalene	TX	6385	10185805
2-Methylphenol (o-Cresol)	TX	6400	10185805
2-Naphthylamine	TX	6430	10185407
2-Nitroaniline	TX	6460	10185805



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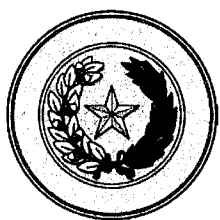
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Matrix: *Non-Potable Water*

2-Nitrophenol	TX	6490	10185805
2-Picoline (2-Methylpyridine)	TX	5050	10185805
3,3'-Dichlorobenzidine	TX	5945	10185805
3,3'-Dimethylbenzidine	TX	6120	10185407
3-Methylcholanthrene	TX	6355	10185601
3-Methylphenol (m-Cresol)	TX	6405	10185805
3-Nitroaniline	TX	6465	10185805
4,4'-Methylenebis(n,n-dimethylaniline)	TX	6370	10185805
4-Aminobiphenyl	TX	5540	10185203
4-Bromophenyl phenyl ether (BDE-3)	TX	5660	10185805
4-Chloro-3-methylphenol	TX	5700	10185805
4-Chloroaniline	TX	5745	10185805
4-Chlorophenyl phenylether	TX	5825	10185805
4-Dimethyl aminoazobenzene	TX	6105	10186002
4-Methylphenol (p-Cresol)	TX	6410	10185805
4-Nitroaniline	TX	6470	10185805
4-Nitrophenol	TX	6500	10185805
5-Nitro-o-toluidine	TX	6570	10185805
7,12-Dimethylbenz(a) anthracene	TX	6115	10185805
a-a-Dimethylphenethylamine	TX	6125	10185601
Acenaphthene	TX	5500	10185805
Acenaphthylene	TX	5505	10185805
Acetophenone	TX	5510	10185601
Aniline	TX	5545	10185805
Anthracene	TX	5555	10185805
Aramite	TX	5560	10185407
Atrazine	TX	7065	10185805
Benzenethiol (Thiophenol)	TX	6750	10185805
Benzidine	TX	5595	10185805
Benzo(a)anthracene	TX	5575	10185805



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Matrix: *Non-Potable Water*

Benzo(a)pyrene	TX	5580	10185805
Benzo(b)fluoranthene	TX	5585	10185805
Benzo(g,h,i)perylene	TX	5590	10185805
Benzo(k)fluoranthene	TX	5600	10185805
Benzoic acid	TX	5610	10185805
Benzyl alcohol	TX	5630	10185805
Biphenyl	TX	5640	10185407
bis(2-Chloroethoxy)methane	TX	5760	10185805
bis(2-Chloroethyl) ether	TX	5765	10185805
bis(2-Chloroisopropyl) ether	TX	5780	10185805
bis(2-Ethylhexyl) phthalate (DEHP)	TX	6255	10185805
Butyl benzyl phthalate	TX	5670	10185805
Caprolactam	TX	7180	10185805
Carbazole	TX	5680	10185805
Chlorobenzilate	TX	7260	10186002
Chrysene	TX	5855	10185805
Diallate	TX	7405	10185407
Dibenz(a,h) anthracene	TX	5895	10185805
Dibenz(a,j) acridine	TX	5900	10185805
Dibenzofuran	TX	5905	10185805
Diethyl phthalate	TX	6070	10185805
Dimethoate	TX	7475	10185407
Dimethyl phthalate	TX	6135	10185805
Di-n-butyl phthalate	TX	5925	10185805
Di-n-octyl phthalate	TX	6200	10185805
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	TX	8620	10185805
Diphenylamine	TX	6205	10185805
Disulfoton	TX	8625	10185601
Ethyl methanesulfonate	TX	6260	10185203
Famphur	TX	7580	10185203



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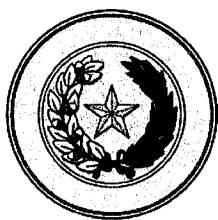
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Matrix: Non-Potable Water

Fluoranthene	TX	6265	10185805
Fluorene	TX	6270	10185805
Hexachlorobenzene	TX	6275	10185805
Hexachlorobutadiene	TX	4835	10185805
Hexachlorocyclopentadiene	TX	6285	10185805
Hexachloroethane	TX	4840	10185805
Hexachlorophene	TX	6290	10186002
Hexachloropropene	TX	6295	10185601
Indeno(1,2,3-cd) pyrene	TX	6315	10185805
Isodrin	TX	7725	10185601
Isophorone	TX	6320	10185805
Isosafrole	TX	6325	10185407
Kepone	TX	7740	10185601
Methapyrilene	TX	6345	10185805
Methyl methanesulfonate	TX	6375	10186002
Methyl parathion (Parathion, methyl)	TX	7825	10185203
Naphthalene	TX	5005	10185805
Nitrobenzene	TX	5015	10185805
Nitroquinoline-1-oxide	TX	6515	10185601
n-Nitrosodiethylamine	TX	6525	10185805
n-Nitrosodimethylamine	TX	6530	10185805
n-Nitrosodi-n-butylamine	TX	5025	10185805
n-Nitrosodi-n-propylamine	TX	6545	10185805
n-Nitrosodiphenylamine	TX	6535	10185805
n-Nitrosomethylethylamine	TX	6550	10185805
n-Nitrosomorpholine	TX	6555	10185407
n-Nitrosopiperidine	TX	6560	10186002
n-Nitrosopyrrolidine	TX	6565	10185203
o,o,o-Triethyl phosphorothioate	TX	8290	10185407
Parathion, ethyl	TX	7955	10185805



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Matrix: Non-Potable Water

Pentachlorobenzene	TX	6590	10185805
Pentachloronitrobenzene (PCNB)	TX	6600	10185203
Pentachlorophenol	TX	6605	10185805
Phenacetin	TX	6610	10185601
Phenanthrene	TX	6615	10185805
Phenol	TX	6625	10185805
Phorate	TX	7985	10185203
Pronamide (Kerb)	TX	6650	10185407
Pyrene	TX	6665	10185805
Pyridine	TX	5095	10185805
Quinoline	TX	6670	10185805
Safrole	TX	6685	10185407
Sulfotepp	TX	8155	10185805
Thionazin (Zinophos)	TX	8235	10185805

Method EPA 8316

Analyte	AB	Analyte ID	Method ID
Acrolein (Propenal)	TX	4325	10188202
Acrylamide	TX	4330	10188202
Acrylonitrile	TX	4340	10188202

Method EPA 9012

Analyte	AB	Analyte ID	Method ID
Amenable cyanide	TX	1510	10193201
Total cyanide	TX	1645	10193405

Method EPA 9040

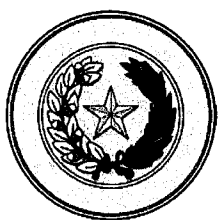
Analyte	AB	Analyte ID	Method ID
pH	TX	1900	10197203

Method EPA 9050

Analyte	AB	Analyte ID	Method ID
Conductivity	TX	1610	10198808

Method EPA 9056

Analyte	AB	Analyte ID	Method ID
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Matrix: Non-Potable Water

Method SM 4500-SO₃⁻ B

Analyte
Sulfite

AB
TX

Analyte ID
2015

Method ID
20026806

Method SM 5210 B

Analyte
Biochemical oxygen demand (BOD)
Carbonaceous BOD, CBOD

AB
TX
TX

Analyte ID
1530
1555

Method ID
20027401
20027401

Method SM 5220 D

Analyte
Chemical oxygen demand (COD)

AB
TX

Analyte ID
1565

Method ID
20027809

Method SM 5310 C

Analyte
Total Organic Carbon (TOC)

AB
TX

Analyte ID
2040

Method ID
20138209

Method SM 5540 C

Analyte
Surfactants - MBAS

AB
TX

Analyte ID
2025

Method ID
20144405

Method SM 9222 B

Analyte
Total coliforms

AB
TX

Analyte ID
2500

Method ID
20198009

Method SM 9222 D

Analyte
Fecal coliforms (enumeration)

AB
TX

Analyte ID
2530

Method ID
20037405

Method TCEQ 1005

Analyte
Total Petroleum Hydrocarbons (TPH)

AB
TX

Analyte ID
2050

Method ID
90019208



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Matrix: Solid & Chemical Materials

Method EPA 1010

Analyte

Ignitability

AB

TX

Analyte ID

1780

Method ID

10116606

Method EPA 1311

Analyte

TCLP

AB

TX

Analyte ID

849

Method ID

10118806

Method EPA 1312

Analyte

SPLP

AB

TX

Analyte ID

850

Method ID

10119003

Method EPA 300.0

Analyte

Bromide

AB

TX

Analyte ID

1540

Method ID

10053006

Chloride

TX

1575

10053006

Fluoride

TX

1730

10053006

Nitrate as N

TX

1810

10053006

Nitrite as N

TX

1840

10053006

Orthophosphate as P

TX

1870

10053006

Sulfate

TX

2000

10053006

Method EPA 350.1

Analyte

Ammonia as N

AB

TX

Analyte ID

1515

Method ID

10063408

Method EPA 353.2

Analyte

Nitrate as N

AB

TX

Analyte ID

1810

Method ID

10067604

Nitrate-nitrite

TX

1820

10067604

Nitrite as N

TX

1840

10067604

Method EPA 6010

Analyte

Aluminum

AB

TX

Analyte ID

1000

Method ID

10155609

Antimony

TX

1005

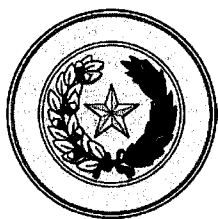
10155609

Arsenic

TX

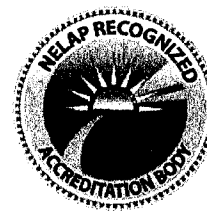
1010

10155609



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Matrix: *Solid & Chemical Materials*

Barium	TX	1015	10155609
Beryllium	TX	1020	10155609
Boron	TX	1025	10155609
Cadmium	TX	1030	10155609
Calcium	TX	1035	10155609
Chromium	TX	1040	10155609
Cobalt	TX	1050	10155609
Copper	TX	1055	10155609
Iron	TX	1070	10155609
Lead	TX	1075	10155609
Lithium	TX	1080	10155609
Magnesium	TX	1085	10155609
Manganese	TX	1090	10155609
Molybdenum	TX	1100	10155609
Nickel	TX	1105	10155609
Potassium	TX	1125	10155609
Selenium	TX	1140	10155609
Silica as SiO ₂	TX	1990	10155609
Silver	TX	1150	10155609
Sodium	TX	1155	10155609
Strontium	TX	1160	10155609
Thallium	TX	1165	10155609
Tin	TX	1175	10155609
Titanium	TX	1180	10155609
Vanadium	TX	1185	10155609
Zinc	TX	1190	10155609

Method EPA 6020

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10156408
Antimony	TX	1005	10156408



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Matrix: Solid & Chemical Materials

Arsenic	TX	1010	10156408
Barium	TX	1015	10156408
Beryllium	TX	1020	10156408
Cadmium	TX	1030	10156408
Calcium	TX	1035	10156408
Chromium	TX	1040	10156408
Cobalt	TX	1050	10156408
Copper	TX	1055	10156408
Iron	TX	1070	10156408
Lead	TX	1075	10156408
Magnesium	TX	1085	10156408
Manganese	TX	1090	10156408
Molybdenum	TX	1100	10156408
Nickel	TX	1105	10156408
Potassium	TX	1125	10156408
Selenium	TX	1140	10156408
Silver	TX	1150	10156408
Sodium	TX	1155	10156408
Strontium	TX	1160	10156408
Thallium	TX	1165	10156408
Vanadium	TX	1185	10156408
Zinc	TX	1190	10156408

Method EPA 7196

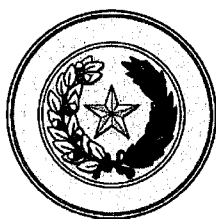
Analyte	AB	Analyte ID	Method ID
Chromium (VI)	TX	1045	10162400

Method EPA 7470

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10165807

Method EPA 7471

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10166004



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Matrix: Solid & Chemical Materials

Aroclor-1242 (PCB-1242)	TX	8895	10179007
Aroclor-1248 (PCB-1248)	TX	8900	10179007
Aroclor-1254 (PCB-1254)	TX	8905	10179007
Aroclor-1260 (PCB-1260)	TX	8910	10179007
PCBs (total)	TX	8870	10179007

Method EPA 8151

Analyte	AB	Analyte ID	Method ID
2,4,5-T	TX	8655	10183207
2,4-D	TX	8545	10183207
2,4-DB	TX	8560	10183207
4-Nitrophenol	TX	6500	10183207
Dalapon	TX	8555	10183207
Dicamba	TX	8595	10183207
Dichloroprop (Dichloroprop, Weedone)	TX	8605	10183207
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	TX	8620	10183207
MCPA	TX	7775	10183207
MCPP	TX	7780	10183207
Pentachlorophenol	TX	6605	10183207
Picloram	TX	8645	10183207
Silvex (2,4,5-TP)	TX	8650	10183207

Method EPA 8260

Analyte	AB	Analyte ID	Method ID
1,1,1,2-Tetrachloroethane	TX	5105	10184802
1,1,1-Trichloroethane	TX	5160	10184802
1,1,2,2-Tetrachloroethane	TX	5110	10184802
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	TX	5195	10184608
1,1,2-Trichloroethane	TX	5165	10184802
1,1-Dichloroethane	TX	4630	10184802
1,1-Dichloroethylene	TX	4640	10184802
1,1-Dichloropropene	TX	4670	10184802
1,2,3-Trichlorobenzene	TX	5150	10184802



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Matrix: *Solid & Chemical Materials*

1,2,3-Trichloropropane	TX	5180	10184802
1,2,4-Trichlorobenzene	TX	5155	10184802
1,2,4-Trimethylbenzene	TX	5210	10184802
1,2-Dibromo-3-chloropropane (DBCP)	TX	4570	10184802
1,2-Dibromoethane (EDB, Ethylene dibromide)	TX	4585	10184802
1,2-Dichlorobenzene	TX	4610	10184802
1,2-Dichloroethane (Ethylene dichloride)	TX	4635	10184802
1,2-Dichloropropane	TX	4655	10184802
1,3,5-Trimethylbenzene	TX	5215	10184802
1,3-Dichlorobenzene	TX	4615	10184802
1,3-Dichloropropane	TX	4660	10184802
1,4-Dichlorobenzene	TX	4620	10184802
1,4-Dioxane (1,4-Diethyleneoxide)	TX	4735	10184802
1-Chlorohexane	TX	4510	10184802
2,2-Dichloropropane	TX	4665	10184802
2-Butanone (Methyl ethyl ketone, MEK)	TX	4410	10184802
2-Chloroethyl vinyl ether	TX	4500	10184802
2-Chlorotoluene	TX	4535	10184802
2-Hexanone (MBK)	TX	4860	10184802
2-Nitropropane	TX	5020	10184802
4-Chlorotoluene	TX	4540	10184802
4-Isopropyltoluene (p-Cymene)	TX	4915	10184802
4-Methyl-2-pentanone (MIBK)	TX	4995	10184802
Acetone (2-Propanone)	TX	4315	10184802
Acetonitrile	TX	4320	10184404
Acrolein (Propenal)	TX	4325	10184802
Acrylonitrile	TX	4340	10184802
Allyl chloride (3-Chloropropene)	TX	4355	10184404
Benzene	TX	4375	10184802
Benzyl chloride	TX	5635	10184802



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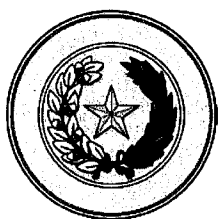
Issue Date:

4/9/2014

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Matrix: *Solid & Chemical Materials*

Bromobenzene	TX	4385	10184802
Bromochloromethane	TX	4390	10184802
Bromodichloromethane	TX	4395	10184802
Bromoform	TX	4400	10184802
Carbon disulfide	TX	4450	10184802
Carbon tetrachloride	TX	4455	10184802
Chlorobenzene	TX	4475	10184802
Chlorodibromomethane	TX	4575	10184802
Chloroethane (Ethyl chloride)	TX	4485	10184802
Chloroform	TX	4505	10184802
Chloroprene (2-Chloro-1,3-butadiene)	TX	4525	10184802
cis-1,2-Dichloroethylene	TX	4645	10184802
cis-1,3-Dichloropropene	TX	4680	10184802
Crotonaldehyde	TX	4545	10184802
Dibromomethane (Methylene bromide)	TX	4595	10184802
Dichlorodifluoromethane (Freon-12)	TX	4625	10184802
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	TX	4745	10184802
Ethanol	TX	4750	10184802
Ethyl acetate	TX	4755	10184802
Ethyl methacrylate	TX	4810	10184802
Ethylbenzene	TX	4765	10184802
Ethylene oxide	TX	4795	10184802
Hexachlorobutadiene	TX	4835	10184802
Hexachloroethane	TX	4840	10184608
Iodomethane (Methyl iodide)	TX	4870	10184802
Isobutyl alcohol (2-Methyl-1-propanol)	TX	4875	10184608
Isopropylbenzene (Cumene)	TX	4900	10184802
m+p-xylene	TX	5240	10184802
Methacrylonitrile	TX	4925	10184404
Methyl acetate	TX	4940	10184404



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Matrix: *Solid & Chemical Materials*

Methyl acrylate	TX	4945	10184802
Methyl bromide (Bromomethane)	TX	4950	10184802
Methyl chloride (Chloromethane)	TX	4960	10184802
Methyl methacrylate	TX	4990	10184404
Methyl tert-butyl ether (MTBE)	TX	5000	10184802
Methylcyclohexane	TX	4965	10184404
Methylene chloride (Dichloromethane)	TX	4975	10184802
Naphthalene	TX	5005	10184802
n-Butyl alcohol (1-Butanol, n-Butanol)	TX	4425	10184608
n-Butylbenzene	TX	4435	10184802
n-Propylbenzene	TX	5090	10184802
o-Xylene	TX	5250	10184802
Pentachloroethane	TX	5035	10184802
Propionitrile (Ethyl cyanide)	TX	5080	10184404
sec-Butylbenzene	TX	4440	10184802
Styrene	TX	5100	10184802
tert-Butyl alcohol	TX	4420	10184802
tert-Butylbenzene	TX	4445	10184802
Tetrachloroethylene (Perchloroethylene)	TX	5115	10184802
Toluene	TX	5140	10184802
trans-1,2-Dichloroethylene	TX	4700	10184802
trans-1,3-Dichloropropylene	TX	4685	10184802
trans-1,4-Dichloro-2-butene	TX	4605	10184802
Trichloroethene (Trichloroethylene)	TX	5170	10184802
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	TX	5175	10184802
Vinyl acetate	TX	5225	10184802
Vinyl chloride	TX	5235	10184802
Xylene (total)	TX	5260	10184802

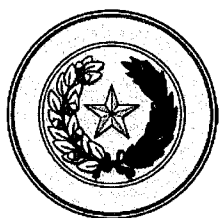
Method EPA 8270

Analyte

AB

Analyte ID

Method ID



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Matrix: Solid & Chemical Materials

1,2,4,5-Tetrachlorobenzene	TX	6715	10185805
1,2,4-Trichlorobenzene	TX	5155	10185805
1,2-Dichlorobenzene	TX	4610	10185805
1,2-Diphenylhydrazine	TX	6220	10185805
1,3,5-Trinitrobenzene (1,3,5-TNB)	TX	6885	10185601
1,3-Dichlorobenzene	TX	4615	10185805
1,3-Dinitrobenzene (1,3-DNB)	TX	6160	10185407
1,4-Dichlorobenzene	TX	4620	10185805
1,4-Naphthoquinone	TX	6420	10185601
1,4-Phenylenediamine	TX	6630	10186002
1-Chloronaphthalene	TX	5790	10185805
1-Naphthylamine	TX	6425	10185203
2,3,4,6-Tetrachlorophenol	TX	6735	10185805
2,4,5-Trichlorophenol	TX	6835	10185805
2,4,6-Trichlorophenol	TX	6840	10185805
2,4-Diaminotoluene	TX	5880	10185407
2,4-Dichlorophenol	TX	6000	10185805
2,4-Dimethylphenol	TX	6130	10185805
2,4-Dinitrophenol	TX	6175	10185805
2,4-Dinitrotoluene (2,4-DNT)	TX	6185	10185805
2,6-Dichlorophenol	TX	6005	10185203
2,6-Dinitrotoluene (2,6-DNT)	TX	6190	10185805
2-Acetylaminofluorene	TX	5515	10185407
2-Chloronaphthalene	TX	5795	10185805
2-Chlorophenol	TX	5800	10185805
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	TX	6360	10185805
2-Methylaniline (o-Toluidine)	TX	5145	10185407
2-Methylnaphthalene	TX	6385	10185805
2-Methylphenol (o-Cresol)	TX	6400	10185805
2-Naphthylamine	TX	6430	10185407



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Matrix: *Solid & Chemical Materials*

2-Nitroaniline	TX	6460	10185805
2-Nitrophenol	TX	6490	10185805
2-Picoline (2-Methylpyridine)	TX	5050	10185805
3,3'-Dichlorobenzidine	TX	5945	10185805
3,3'-Dimethylbenzidine	TX	6120	10185805
3-Methylcholanthrene	TX	6355	10185407
3-Methylphenol (m-Cresol)	TX	6405	10185805
3-Nitroaniline	TX	6465	10185805
4-Aminobiphenyl	TX	5540	10185805
4-Bromophenyl phenyl ether (BDE-3)	TX	5660	10185805
4-Chloro-3-methylphenol	TX	5700	10185805
4-Chloroaniline	TX	5745	10185805
4-Chlorophenyl phenylether	TX	5825	10185805
4-Methylphenol (p-Cresol)	TX	6410	10185805
4-Nitroaniline	TX	6470	10185805
4-Nitrophenol	TX	6500	10185805
5-Nitro-o-toluidine	TX	6570	10185805
7,12-Dimethylbenz(a) anthracene	TX	6115	10185805
a-a-Dimethylphenethylamine	TX	6125	10186002
Acenaphthene	TX	5500	10185805
Acenaphthylene	TX	5505	10185805
Acetophenone	TX	5510	10185805
Aniline	TX	5545	10185805
Anthracene	TX	5555	10185805
Aramite	TX	5560	10185203
Atrazine	TX	7065	10185407
Benzenethiol (Thiophenol)	TX	6750	10185805
Benzidine	TX	5595	10185805
Benzo(a)anthracene	TX	5575	10185805
Benzo(a)pyrene	TX	5580	10185805



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Matrix: Solid & Chemical Materials

Benzo(b)fluoranthene	TX	5585	10185805
Benzo(g,h,i)perylene	TX	5590	10185805
Benzo(k)fluoranthene	TX	5600	10185805
Benzoic acid	TX	5610	10185805
Benzyl alcohol	TX	5630	10185805
Biphenyl	TX	5640	10185805
bis(2-Chloroethoxy)methane	TX	5760	10185805
bis(2-Chloroethyl) ether	TX	5765	10185805
bis(2-Chloroisopropyl) ether	TX	5780	10185805
bis(2-Ethylhexyl) phthalate (DEHP)	TX	6255	10185805
Butyl benzyl phthalate	TX	5670	10185805
Caprolactam	TX	7180	10186002
Carbazole	TX	5680	10185805
Chlorobenzilate	TX	7260	10185203
Chrysene	TX	5855	10185805
Diallate	TX	7405	10186002
Dibenz(a,h) anthracene	TX	5895	10185805
Dibenz(a,j) acridine	TX	5900	10185805
Dibenzofuran	TX	5905	10185805
Diethyl phthalate	TX	6070	10185805
Dimethoate	TX	7475	10186002
Dimethyl phthalate	TX	6135	10185805
Di-n-butyl phthalate	TX	5925	10185805
Di-n-octyl phthalate	TX	6200	10185805
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	TX	8620	10185805
Diphenylamine	TX	6205	10185805
Disulfoton	TX	8625	10186002
Ethyl methanesulfonate	TX	6260	10185203
Famphur	TX	7580	10185407
Fluoranthene	TX	6265	10185805



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Matrix: *Solid & Chemical Materials*

Fluorene	TX	6270	10185805
Hexachlorobenzene	TX	6275	10185805
Hexachlorobutadiene	TX	4835	10185805
Hexachlorocyclopentadiene	TX	6285	10185805
Hexachloroethane	TX	4840	10185805
Hexachlorophene	TX	6290	10185203
Hexachloropropene	TX	6295	10186002
Indeno(1,2,3-cd) pyrene	TX	6315	10185805
Isodrin	TX	7725	10186002
Isophorone	TX	6320	10185805
Isosafrole	TX	6325	10186002
Kepone	TX	7740	10185805
Methapyrilene	TX	6345	10185601
Methyl methanesulfonate	TX	6375	10185601
Methyl parathion (Parathion, methyl)	TX	7825	10185203
Naphthalene	TX	5005	10185805
Nitrobenzene	TX	5015	10185805
Nitroquinoline-1-oxide	TX	6515	10185805
n-Nitrosodiethylamine	TX	6525	10185805
n-Nitrosodimethylamine	TX	6530	10185805
n-Nitrosodi-n-butylamine	TX	5025	10185805
n-Nitrosodi-n-propylamine	TX	6545	10185805
n-Nitrosodiphenylamine	TX	6535	10185805
n-Nitrosomethylethylamine	TX	6550	10185805
n-Nitrosomorpholine	TX	6555	10185805
n-Nitrosopiperidine	TX	6560	10185601
n-Nitrosopyrrolidine	TX	6565	10186002
o,o,o-Triethyl phosphorothioate	TX	8290	10185203
Parathion, ethyl	TX	7955	10185601
Pentachlorobenzene	TX	6590	10185805



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Matrix: Solid & Chemical Materials

Pentachloronitrobenzene (PCNB)	TX	6600	10186002
Pentachlorophenol	TX	6605	10185805
Phenacetin	TX	6610	10185805
Phenanthrene	TX	6615	10185805
Phenol	TX	6625	10185805
Phorate	TX	7985	10185203
Pronamide (Kerb)	TX	6650	10185407
Pyrene	TX	6665	10185805
Pyridine	TX	5095	10185805
Quinoline	TX	6670	10185601
Resorcinol	TX	6680	10185805
Safrole	TX	6685	10185805
Sulfotepp	TX	8155	10186002
Thionazin (Zinophos)	TX	8235	10185805

Method EPA 8316

Analyte	AB	Analyte ID	Method ID
Acrolein (Propenal)	TX	4325	10188202
Acrylamide	TX	4330	10188202
Acrylonitrile	TX	4340	10188202

Method EPA 9012

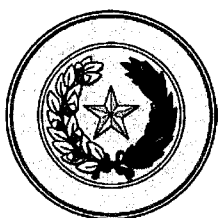
Analyte	AB	Analyte ID	Method ID
Amenable cyanide	TX	1510	10193201
Total cyanide	TX	1645	10193405

Method EPA 9040

Analyte	AB	Analyte ID	Method ID
Corrosivity	TX	1615	10196802
pH	TX	1900	10196802

Method EPA 9045

Analyte	AB	Analyte ID	Method ID
Corrosivity	TX	1615	10244607
pH	TX	1900	10198400



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Matrix: *Solid & Chemical Materials*

Method SM 2320 B

Analyte

Alkalinity as CaCO₃

AB

TX

Analyte ID

1505

Method ID

20045005

Method SM 2510 B

Analyte

Conductivity

AB

TX

Analyte ID

1610

Method ID

20048004

Method SM 2540 G

Analyte

Residue-total (total solids)

AB

TX

Analyte ID

1950

Method ID

20005203

Method SM 9222 B

Analyte

Total coliforms

AB

TX

Analyte ID

2500

Method ID

20198009

Method SM 9222 D

Analyte

Fecal coliforms (enumeration)

AB

TX

Analyte ID

2530

Method ID

20037405

Method SSA/ASA Part 3:34

Analyte

Carbon, organic (Walkley-Black)

AB

TX

Analyte ID

10340

Method ID

SSA/ASA Pt 3:34

Method TCEQ 1005

Analyte

Total Petroleum Hydrocarbons (TPH)

AB

TX

Analyte ID

2050

Method ID

90019208

Appendix C: Project Schedule

*Dates subject to change based on field sampling plan approval and TCEQ Notice to Proceed.

Task	Bullet Description of Activity	Anticipated Start Date*	Anticipated Date of Completion*
Task 1	<ul style="list-style-type: none"> HASP Preparation and FSP Review. 	August 26, 2014	October 17, 2014
Task 2	<ul style="list-style-type: none"> Mobilize to the site and collect a GPS coordinate for the site; Meet with TCEQ and/or EPA representatives to outline the proposed boundaries (as understood from interviews with property representatives) for the community garden; Install 15 soil borings across three identified sections of the site and collect soil samples following a tiered sampling/analysis system; Install three (3) temporary monitoring wells and collect groundwater samples; and Ship samples to the laboratory. 	October 20, 2014	October 31, 2014
Task 3	<ul style="list-style-type: none"> Review laboratory data and submit data review memorandum and associated analytical data packages. 	November 3, 2014	November 14, 2014
Task 4	<ul style="list-style-type: none"> Prepare and submit the Phase II ESA Report. 	November 17, 2014	November 28, 2014
Task 5	<ul style="list-style-type: none"> Coordinate with landfill for waste disposal classification/acceptance and remove investigation derived waste. 	December 1, 2014	December 5, 2014